VOLUME 21 January, 1955 NUMBER 1

THE AMERICAN SURGEON

PUBLISHED MONTHLY BY
THE WILLIAMS & WILKINS COMPANY
BALTIMORE 2, MARYLAND

Entered at the Post Office in Baltimore, Maryland as second-class matter.
Subscription price $10.00

CONTENTS, JANUARY

THE
AMERICAN
SURGEON

Vol. 21, No. 1 January, 1955

CARCINOMA OF THE STOMACH*

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Carcinoma of the stomach is one of the most frequent cancers in men. Although recently superseded in incidence by cancer of the lung, it still remains a very important lesion. According to Steigmann,[28] there are 40,000 deaths annually from the disease. In 1953, cancer of the stomach was responsible for 53.7 deaths per 100,000 population as compared with 17.9 in 1948.

In contradistinction to cancer of the lung, cancer of the stomach has been a common lesion for years; as a matter of fact it was known by the ancients. One in every 200 patients admitted to the Mayo Clinic,[2] has gastric cancer. In our own series at the Ochsner Clinic, 1 in every 555 patients admitted had a malignant lesion of the stomach and 1 in every 588 had a gastric carcinoma. The incidence of gastric carcinoma in the Charity Hospital in New Orleans[4] was 1 in every 265 admissions.

A lesion as common as cancer of the stomach should be relatively easily diagnosed and the therapy should be satisfactory. Such, however, is not the case. Although every physician has had impressed upon him the frequency of cancer of the stomach, and should suspect a malignant gastric lesion in all patients past 40 years of age who develop gastric symptoms which cannot be explained otherwise, the end results of treatment of gastric cancer are far from good. The operability rate in different institutions varies considerably from an extremely high one of 88.9 per cent reported by Bocharov[3] to a low operability rate of 50 per cent reported by Allen[1] and Clark.[8] In our series in the Ochsner Clinic, the operability incidence was 80.3 per cent.

The resectability incidence, on the other hand, is considerably lower than the

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Presented during the Oklahoma City assembly of The Southwestern Surgical Congress, Oklahoma City, Oklahoma, Sept. 20–22, 1954.

operability incidence, as is obvious. The highest reported is that by Winkelbauer,[34] 54 per cent. The lowest is 25 per cent reported by Clark.[8] Clark further showed that of all the reported cases of the gastric cancer in the large metropolitan area of Houston, Texas, only 30 per cent were operable and only 5.7 per cent were resectable. In 37 per cent of our patients, a resection was possible. Unfortunately, however, in a good many of the patients who were subjected to resection the disease was too far advanced for a cure to be obtained. In only 12.5 per cent of our patients was the lesion apparently limited to the stomach.

The five year survival rate of all the patients admitted to various institutions is extremely low, varying from about 5 per cent[8] to 14 per cent.[2] Whereas previously, we had a five year survival rate of 9.9 per cent of all the patients admitted, in a more recent study the five year survival rate is 7.2 per cent.

These statistics indicate that something should be done, if at all possible, to improve the results obtained in the treatment of gastric cancer, because a condition which is as common as gastric cancer, and which has been common since the beginning of medical history, should be more amenable to therapy than it has been in the past. It has been our conviction that the profession has been complacent about gastric cancer and that because of this, it usually is diagnosed late. It frequently is stated that the diagnosis of gastric cancer is easy and that it can be made by roentgenogram in over 95 per cent of the cases. Undoubtedly, this is true in far advanced lesions. On the other hand, the early diagnosis of gastric cancer is not easy, and unless diagnosis is made early, and patients with gastric cancer are subjected to radical surgical therapy while the lesion still is limited to the stomach, the results will continue to be bad.

Recently, numerous investigators have suggested that one of the reasons why the results in the surgical treatment of stomach cancer have been bad is that incomplete operations have been done, and that this situation can be corrected only by performing total gastrectomy in all patients. As we[22] previously emphasized, total gastrectomy is of value in proximally located lesions but we are of the opinion that in the distally located lesions, it offers no more as regards total salvage rates than does a radical subtotal resection of the stomach.

Unfortunately, there has been some confusion about what constitutes a radical subtotal resection, and far too frequently a subtotal resection of the stomach is described when in reality only a small part of the stomach has been removed. McNeer and associates[20] studied 92 patients at autopsy who previously had had gastrectomy for gastric cancer; in 46 (50 per cent) there was local recurrence of carcinoma either at the gastroenterostomy site or in the wall of the stomach within varying periods of time from 2 to 75 months after the gastrectomy. In 60 patients in whom it was possible to determine the extent of the resection, there was no local recurrence in 16 and local recurrence in 44. Of the 44 patients with local recurrence, 7 (15.9 per cent) had had less than ¼ of the stomach resected; 15 (34.1 per cent) had had ½ resected; 20 (45.5 per cent) had had from ½ to ¾ resected, and only 2 (4.5 per cent) had more than ¾ resected. Of the 16 with no local recurrences, 4 (25 per cent) had had less than 25 per cent of the stomach resected; 4 (25 per cent) had had ¼ to ½ resected, and

7 (43.8 per cent) had had from ½ to ¾ resected. Only 2 (6.3 per cent) had had more than ¾ of the stomach resected. It is interesting that only 3 of the 60 patients who had had gastrectomies for carcinoma had had more than 75 per cent of the stomach removed. It is obvious, therefore, that one must define what is meant by a radical subtotal gastrectomy for gastric carcinoma.

We[22] previously have described radical total gastrectomy as follows: "Removal of the first portion of the duodenum and all the lesser curvature up to the cardia. Removal of all the greater curvature up to within 5 or 6 cm. of the cardia; removal of all the gastrohepatic omentum; the gastrocolic omentum and the greater omentum; careful dissection of and removal of the lymph nodes along the lesser curvature, especially those around the celiac axis and the left gastric vessels; the subpyloric nodes; the subhepatic nodes; the gastrolineal nodes and the paraesophageal nodes" (fig. 1).

It is important to remove the first portion of the duodenum because, contrary to what was previously thought, gastric cancer can extend onto and involve the duodenum. Coller and associates[9] found by careful microscopic examination of the removed specimen following gastrectomy for carcinoma that the duodenum was involved in 26.4 per cent. McNeer and his associates,[20] in a study of a series of patients who had been subjected to gastrectomy and subsequently to autopsy, found involvement of the duodenal stump in 9.8 per cent. Harvey and associates[16] found in a series of 270 patients in whom resection was done that the duodenum was involved in 53 and the esophagus in 34. More than one-fourth of the antral tumors had invaded the duodenum. Konjetzny[18] found the duodenum involved in 67 per cent of his patients. Castleman[7] stated that carcinoma of the distal end of the stomach frequently involved the duodenum but rarely extended beyond 1 cm. Kuhne[19] found the duodenum involved in 7 of 87 gastric resections; he states that the greatest danger is in the mucinous type of carcinoma.

As mentioned previously, all patients with lesions in the proximal portion of the stomach should have complete removal of the stomach, together with the distal portion of the esophagus. Total gastrectomy probably should be done in

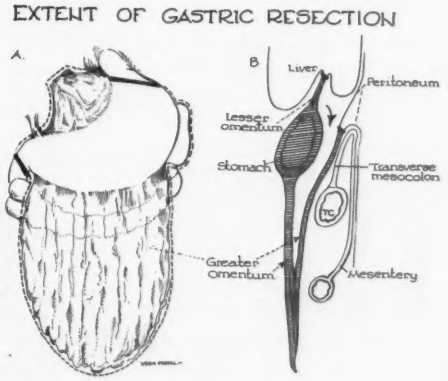

FIG. 1

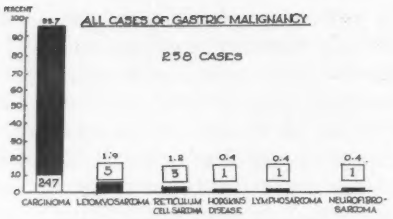

FIG. 2

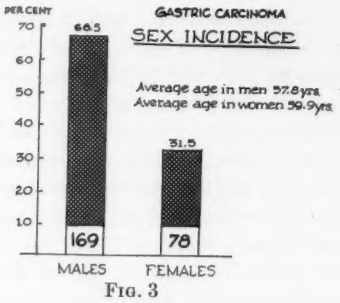

FIG. 3

all patients with infiltrative carcinoma, because the infiltrative type of carcinoma, or the scirrhous variety, notoriously is likely to extend for great distances through the gastric wall without evidence of gross involvement. Eker and Eskind[12] found, in a series of 80 specimens removed for gastric cancer, that the muciferous scirrhous carcinomas spread through the lymphatics, whereas adenocarcinomas spread in continuity; the former spread little in the mucosa but considerably in the submucosa and the deeper layers. Eguia[11] emphasized that the intramural type of cancer extends well beyond the gross lesion, particularly submucously and subserously and, that it extends up into the esophagus in 87 per cent and into the duodenum in 37 per cent. In his series, lymph node metastasis occurred in 73 per cent of the cancers. When the tumors were located in the upper half of the stomach metastasis occurred in 89 per cent, whereas when they were located in the pyloric antrum, it occurred in 53 per cent.

In the Ochsner Clinic from Jan. 1, 1942 to Jan. 1, 1954, there were 258 cases of primary gastric malignant lesions of which 247 (95.7 per cent) were carcinomas; 5 (1.9 per cent) were leiomyosarcoma; 3 (1.2 per cent) reticulum cell sarcoma, and 1 each (0.4 per cent) Hodgkins' disease, lymphosarcoma and neurofibrosarcoma (fig. 2). Of the 247 patients with gastric carcinoma, 169 (68.5 per cent) were men and 78 (31.5 per cent) were women (fig. 3). The average age, in the women, was 59.9 years and in the men, 57.8 years. Almost two-thirds occurred between 50 and 70 years of age (fig. 4). In men, only 13.6 per cent of the gastric cancers occurred before 50 years of age and 68 per cent occurred between 50 and 70 years of age (fig. 5), whereas in women, approximately 17 per cent occurred

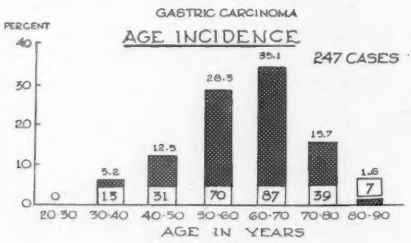

FIG. 4

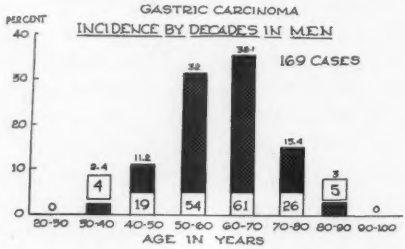

FIG. 5

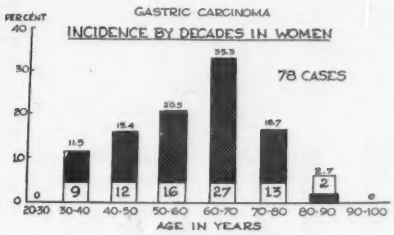

FIG. 6

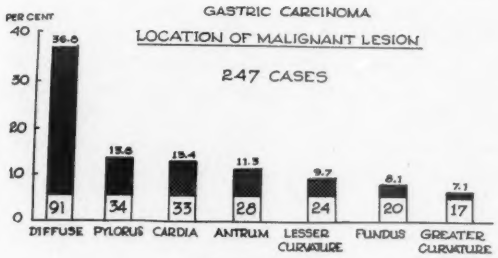

FIG. 7

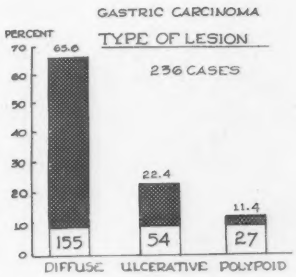

FIG. 8

before 50 years and approximately 54 per cent between 50 and 70 years of age (fig. 6).

The location of the lesions was as follows: diffuse, 36.8 per cent; in the pylorus, 13.8 per cent; in the cardia, 13.4 per cent; in the antrum, 11.3 per cent; on the lesser curvature, 9.7 per cent; in the fundus, 8.1 per cent; and on the greater curvature, 7.1 per cent (fig. 7). In 236 cases in which the type of lesion was described by the pathologist, 155 specimens (65.6 per cent) showed diffuse involvement; 54 (22.4 per cent) were ulcerative and 27 (11.4 per cent) were polypoid (fig. 8).

SYMPTOMS AND SIGNS

Unfortunately, the symptoms produced by cancer of the stomach occur so insidiously that they are likely to be disregarded. All too frequently individuals, as they get older, are of the opinion that discomfort is a necessary price which one pays for advancing age. This is, of course, far from the fact. There is no more reason why a person who enters the second half century of his life should be any more uncomfortable than he was prior to that time.

The classical picture given in most textbooks of gastric cancer represents the late manifestations of the disease and, unfortunately, physicians wait until such a clinical picture occurs before a diagnosis of gastric cancer is made. In our 247 cases of gastric carcinoma, there was an average duration of symptoms of 8.7 months and an average weight loss of 25.7 pounds (fig. 9). Weight loss, in fact, was the most prominent manifestation of gastric cancer, being present in 90 per

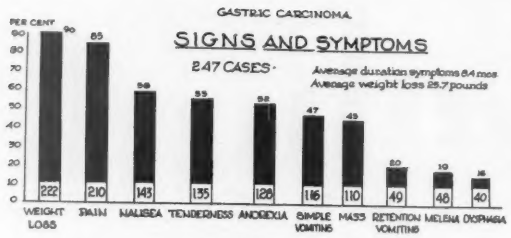

FIG. 9

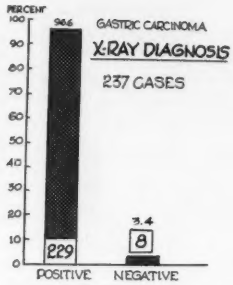

FIG. 10

cent of all patients. It is followed in frequency by epigastric pain, 85 per cent; nausea, 58 per cent; tenderness, 55 per cent; anorexia, 52 per cent; simple vomiting, 47 per cent; palpable mass, 45 per cent; retention vomiting, 20 per cent; melena, 19 per cent; and dysphagia, 16 per cent. Frequently, the only manifestation complained of is anorexia, which is severe enough to be associated with or followed by loss in weight. It is persistent and does not respond to therapy.

DIAGNOSIS

The statement frequently is made that the diagnosis of gastric cancer is extremely easy and can be done with a great deal of certainty by the roentgenogram. This is true in advanced cases but it is not true in early cases. In our series, the roentgenogram was positive in 96.6 per cent of all cases (fig. 10). It is our belief that, unfortunately, when a gastric lesion is large enough to be diagnosed as gastric cancer on the roentgenogram, it has been in existence for a relatively long period of time, and there is considerable likelihood that it may have extended beyond the stomach and become inoperable.

Although mass roentgenography has been suggested as a screening technic for gastric cancer, it has not proved satisfactory and is productive of such a small number of correct diagnoses that it probably is too expensive to use as a screening method. According to Roach and associates[27] only one asymptomatic cancer in 476 examinations was found. Wirh and Swenson[32] reported the results of a survey in a large number of individuals over the age of 45 years, none of whom was symptomatic. Fourteen gastric neoplasms were found, of which 11 were operated upon. These authors[32] estimate that the cost for finding 1 case of asymptomatic stomach cancer was $2500.00. Réné Gutmann[15] of Paris is of the opinion that it is possible to make a diagnosis of gastric cancer relatively early. He believes that the lesion begins very slowly and lasts for a long time before the classical growth, which commonly is recognized as gastric cancer, takes place. If one sees a patient in the phase in which growth is not rapid, there is no danger in taking several months before undertaking operation. He also states that the incidence of malignant involvement varies in different parts of the stomach; that on the lesser curvature, the horizontal portion is the *malignant* area, whereas the vertical portion of the stomach is the *benign* area. He emphasizes the importance

of examining the horizontal portion of the stomach with the patient lying down, with the stomach overfilled, and examining the vertical portion of the stomach with the patient standing.

TREATMENT

Unfortunately, many patients with cancer of the stomach are inoperable when first seen. In the present series of 247 patients, 33 (13.4 per cent) were inoperable when first seen (fig. 11). This incidence is not very different from the incidence of inoperability reported by Troell.[31] There were 214 patients whom we considered operable, of whom 16 (7 per cent) refused surgery. Of 198 who were explored, 107 (54 per cent) were found to be nonresectable; of these, 16 (15 per cent) died within the hospital. Of the 91 patients in whom a resection was done, in 60 (66 per cent) the lesion was advanced and a palliative procedure was done, such as gastrojejunostomy, palliative resection, or some other palliative procedures. Fifteen per cent of these died within the hospital. There were only 31 in whom, presumably, a curative resection was done. This represents 34 per cent of the entire group of resections. Of the 31 patients, 26 (83.8 per cent) had subtotal gastrectomies, with a mortality rate of 7.7 per cent; 4 (13 per cent) had total gastrectomies, with no deaths, and 1 (3.2 per cent) had esophagogastrectomy, with survival. Of the 31 patients in whom a curative procedure was done, only 2 (6.4 per cent) died, as contrasted with the hospital mortality rate of 15 per cent when a palliative procedure was done and a similar mortality in a group of patients in whom no resection could be done but in whom some other type of procedure, either exploration or a palliative procedure such as gastroenterostomy, was done. Obviously, these cases were more advanced and the higher mortality rates in these patients were due to the disease rather than to the operation. Of 60 patients in whom a palliative resection was done, 39 (65 per cent) had subtotal gastrectomy; 13 (21.6 per cent) had total gastrectomy, and 8 (13.3 per cent) had esophagogastrectomy. Of the entire 247 patients, 109 (44.1 per cent) had

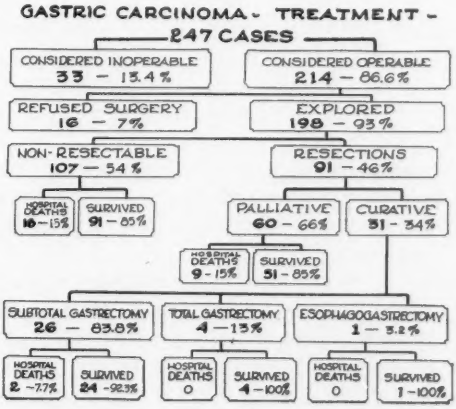

FIG. 11

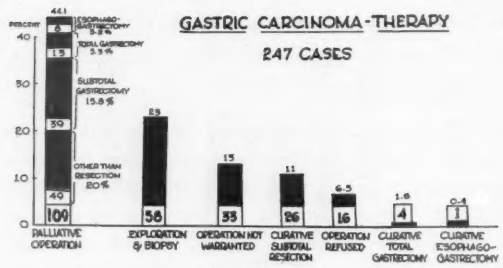

FIG. 12

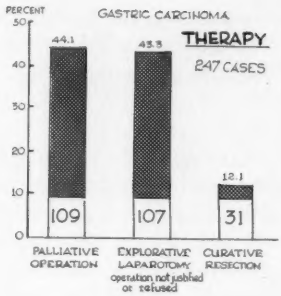

FIG. 13

palliative operations (esophagogastrectomy, 3.2 per cent; total gastrectomy, 5.3 per cent; subtotal gastrectomy, 15.8 per cent; and 20 per cent, some other procedure such as gastrojejunostomy, etc.); 58 (23 per cent), exploration and biopsy; in 33 (13 per cent), the operation was not warranted; 26 (11 per cent) had curative subtotal resection; 16 (6.5 per cent) refused operation; 4 (1.6 per cent) had total gastrectomy, and 1 (0.4 per cent) had curative esophagogastrectomy (fig. 12). Thus, 44.1 per cent had palliative operations, 43.3 per cent had exploratory laparotomy or the operation was not justified or was refused, and 12.1 per cent had curative resections (fig. 13).

SURVIVAL RATE

In the consideration of the results of therapy in any malignant lesion, the long time survival rates are of importance and, in contrast to what so frequently is done, one should determine the survival rates of all the patients seen; not just those who are fortunate enough to survive the operation, because the operation is inherently a part of the treatment of the disease. In our 247 patients, 238 (96.3 per cent) were followed. Of the 9 patients lost to follow-up, none had any chance of cure because in none was gastric resection performed. Many of the patients who died following institution of therapy died of other conditions, but in each instance, we have assumed that the patient died of his disease, regardless of the cause of death. This is an extremely critical evaluation, because approximately 15 per cent of the general population in this age group without cancer of the stomach are dead at the end of five years.

Of the group of patients in whom no resection was done because the lesion was far advanced, 23 per cent were alive at the end of six months; 4 per cent were alive at the end of one year, and 0.7 per cent were alive at the end of two years. No patient lived three years (fig. 14).

Among the patients in whom some type of resection was done, whether it was done as a palliative or as a curative procedure, 71 per cent were alive at the end of six months; 57 per cent at the end of a year; 46 per cent at the end of two years; 31 per cent at the end of three years; 26 per cent at the end of four years, and 21 per cent at the end of five years (fig. 15). Of the group of patients in whom a subtotal resection was done, whether it was done as a palliative procedure or

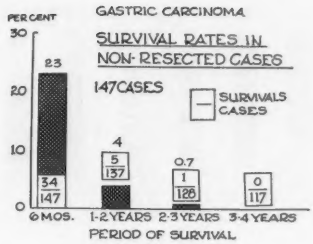

FIG. 14

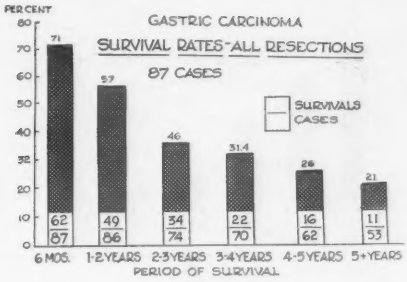

FIG. 15

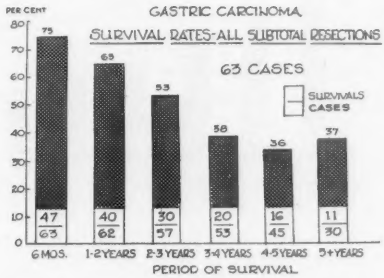

FIG. 16

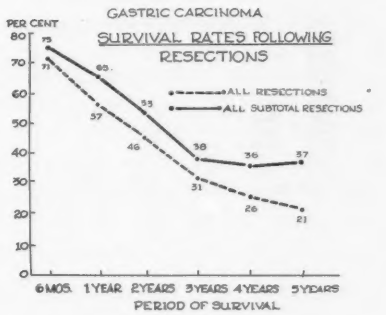

FIG. 17

not, 75 per cent were alive at the end of six months; 65 per cent were alive at the end of a year; 53 per cent at the end of two years; 38 per cent at the end of three years; 36 per cent at the end of four years, and 37 per cent at the end of five years (fig. 16). It is thus seen that radical subtotal resection gave results as good as, or even better than, results of all the resections, which included total gastrectomy as well as esophagogastrectomy (fig. 17).

It must be stated, in all fairness to the more radical procedures, that they were used in the more advanced cases. The analysis does show, however, that radical subtotal resection does give good results. Obviously, the worst results were obtained in those resections in which the lesion had extended beyond the stomach, with involvement of the nodes. Of 37 such patients, 70 per cent were alive at the end of six months; 54 per cent were alive at the end of a year; 40 per cent at the end of two years; 21 per cent at the end of three years; 17 per cent at the end of four years, and 12 per cent at the end of five years (fig. 18). In the group of patients in whom a subtotal resection was done, but in whom no nodal involvement was found, 81 per cent were alive at the end of six months; 80 per cent at the end of a year; 73 per cent at the end of two years; 68.4 per cent at the end of three years; 69 per cent at the end of four years, and 57 per cent at the end of five years (fig. 19). It is thus seen that following subtotal gastric resection for lesions apparently limited to the stomach, the results were good, in that between

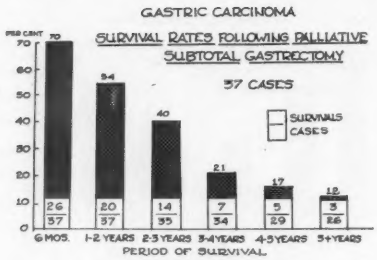

FIG. 18

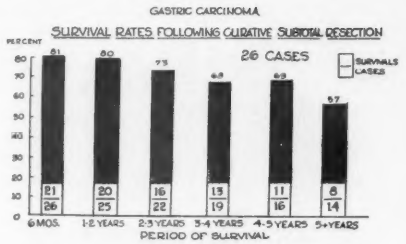

FIG. 19

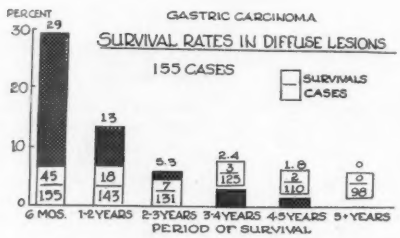

FIG. 20

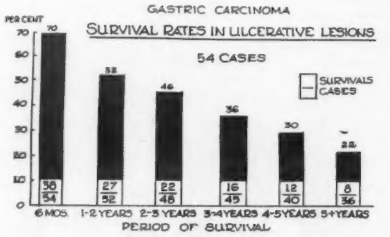

FIG. 21

one-half and two-thirds of the patients were apparently well at the end of five years (fig. 19). Pack and McNeer[24] found that there was a five year survival rate of 24.2 per cent in patients with nodal involvement and of 42.8 per cent in those without nodal involvement. Ransom[26] found that the five year survival rate was 16 per cent when the nodes were involved as compared with 50 per cent when the nodes are not involved.

There was considerable difference in the survival rate according to the type of lesion. Patients with diffuse lesions had the shortest survival rates. Of 155 with diffuse lesions, 29 per cent were alive at the end of six months; 13 per cent at the end of a year; 5.3 per cent at the end of two years; 2.4 per cent at the end of three years, and 1.8 per cent at the end of four years. No patient lived as long as five years (fig. 20). In patients with ulcerative lesions, 70 per cent were alive at the end of six months; 62 per cent at the end of a year; 46 per cent at the end of two years; 36 per cent at the end of three years; 30 per cent at the end of four years, and 22 per cent at the end of five years (fig. 21). The survival rate in the group with polypoid lesions, 27 patients, was as follows: 48 per cent were alive at the end of six months; 36 per cent at the end of a year; 29 per cent at the end of two years; 17 per cent at the end of three years; 19 per cent at the end of four years, and 23 per cent at the end of five years (figs. 22 & 23).

At the present time there is apparently no definite consensus concerning the proper therapy in the treatment of gastric ulcer. Although many ulcers of the stomach are benign, and although it is now generally accepted that benign gastric lesions of the stomach seldom undergo malignant change, it is our belief that all

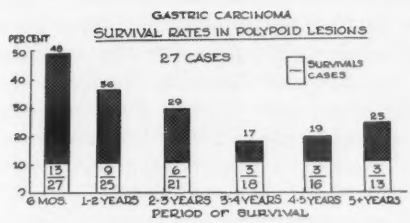

FIG. 22

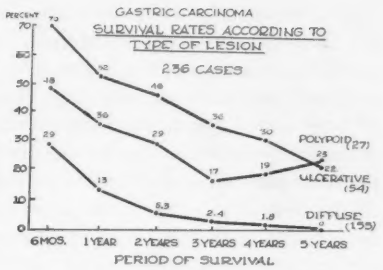

FIG. 23

gastric ulcers should be treated surgically. In spite of the fact that it is considered unusual for gastric ulcers to become cancerous, we are of the opinion that this occurs much more frequently than is commonly thought. Wilson and McCarty,[33] in 1909, found evidence of gastric cancer developing on the basis of pre-existing ulcer in 71 per cent of 153 cases of proved gastric carcinoma. Stout[29] found in a series of 82 patients in whom gastrectomy was done for cancer that there was evidence of cancer developing at the margin of pre-existing ulcer in 13.4 per cent. He states, "Whatever one may believe about the relationship, it can be regarded as certain that whatever factors lead to the development of peptic ulcers are, at least, not unfavorable to the development of gastric cancer." Ekstroem[13] found in a series of 138 patients subjected to radical operations that cancer originated in an ulcer in 16 (11.5 per cent). He found that in 25 per cent of the entire series of 274 patients there was a long history of gastric distress. In 15 per cent of the entire group, there was a great likelihood that a previous ulcer existed, and in 8 per cent, there was unquestionable evidence of a previous ulcer. On the other hand, Brown, Fisher, and Hazard[5] found only 8 instances (1.1 per cent) in 715 cases of gastric ulcer at the Cleveland Clinic during a period from 1945 to 1951. Similarly, Gordet[14] found only 7 cases of cancer which developed in peptic ulcers in 10 years in the Gastroenterological Department at the Salpetrière Hospital in Paris. As also emphasized by Gutmann,[15] these occurred only in the horizontal portion of the stomach.

Whether one accepts the concept that gastric cancer can develop on the basis of gastric ulcer, or does not, makes little difference because, at the present time, it is impossible to determine whether an ulcer of the stomach is benign or malignant. Cain and associates[6] found that the outcome of the conservative treatment of gastric ulcer is not good. They found that the incidence of gastric cancer, in 190 patients in whom surgical treatment was not used and medical treatment was not successful, was 4.8 per cent. In 78 patients in whom surgery was suggested but was refused, 10 (12.8 per cent) were proved to have cancer. In 336 patients in whom medical treatment was started and thought to be the best method of therapy, gastric lesions were found to be cancerous in 33 (9.8 per cent). In 34 (24.3 per cent) of the 140 patients in whom medical treatment was abandoned for surgical treatment, gastric cancer was found.

These authors[6] state that gastric ulcers are likely to recur; that those that recur are likely to be cancer, and that the larger ulcers are likely to be cancer. They emphasize that the risk of operation, if the ulcer is benign, is only about 2 per cent, which is definitely less than the risk of cancer being present, which is about 10 per cent. They further state that the danger of cancer developing in the general population is about 1 per 100,000 in men over 40 years of age, whereas, the incidence of gastric cancer in small ulcerating lesions is about 10 per cent or 100 times as frequent as in the general population. Of their 414 patients, 226 were alive and not operated upon five years after treatment was started. In 11 (4.9 per cent) of these, cancer developed, which is many times the general incidence of cancer of the stomach. They believe that all ulcers of the stomach should be considered as a precursor of cancer of the stomach. Mason[21] states that after the age of 65 years, gastric cancer is found in one of every 500 men in the general population. He believes that gastric cancer can develop on the basis of a pre-existing ulcer and that it may retain the appearance of an ulcer, but that these patients have a better prognosis than other patients who have gastric cancer. Swynnerton and associates[30] found in a series of 375 cases of gastric cancer that 26 (7 per cent) arose in a gastric ulcer. It is obvious, therefore, that all gastric ulcers should be treated surgically and should not be treated conservatively because, even though some of them may be benign, one is unable to determine with accuracy which ones are.

As mentioned previously, it has been suggested that in order to improve the results from treatment of gastric cancer, all patients be subjected to total gastrectomy. However, Troell[31] is of the opinion that total gastrectomy offers relatively little in the treatment of cancer of the stomach, not only because it fails in giving better results, but also because patients frequently are incapacitated after total removal of the stomach. In a series of 54 patients in whom total gastrectomy was done, which represented 11 per cent of 419 patients operated upon, there was an operative mortality rate of 51 per cent. However, of the 26 survivors, 46 per cent died within a year; 80 per cent died within two years, and 88 per cent died within three years. Also, it was found that of the 54 patients, 39 (72 per cent) were not curable, because microscopic examination of the specimen showed that the edges of the material removed were not free from cancer, or that cancer was demonstrable in the regional lymph nodes, or that there was extension into the omentum. Of the 13 in whom there was no evidence of extension beyond the area of resection, 7 died at operation; 3 of the remaining 6 patients died of cancer within 2, 11, and 23 months, and 3 were living six months, two years and three years respectively after the operation. Only 1 of these, however, was in good health. On the other hand, in 169 patients in whom a Billroth II operation was done—which represented 34 per cent of the entire group operated upon—there was a mortality rate of 14 per cent. Of the 145 survivors, 31 per cent died within a year; 56 per cent within two years; 63 per cent within three years; 69 per cent within four years, and 77 per cent within five years. Of the 145 survivors, 9 subsequently died of intercurrent disease. In 19 the pathologic diagnosis showed carcinomatous ulcer. Twenty-four of the

remaining 117 had no evidence of penetration through the serosa and no lymph node metastasis, and 50 per cent of these were surviving at the time of the follow-up. Of the patients in whom there was penetration through the serosa but no lymph node metastasis, 39 per cent were surviving at the follow-up. Of those in whom there was no penetration through the serosa, but lymph node metastasis, 6 per cent were alive at follow-up, and of those in whom there was both penetration through the serosa and lymph node metastasis, 25 per cent were alive at follow-up.

We agree with Troell[31] that total gastrectomy may be indicated in some instances but that one must decide whether it is worthwhile, even though the salvage rate was equal or somewhat better than that in radical subtotal resection. It is our belief that the persistence of symptoms following a total gastrectomy is not due to the lack of a reservoir, and that operations devised to produce a reservoir are not likely to decrease the incidence of postoperative morbidity. In the radical subtotal gastrectomy which we do, as described above, the remaining pouch is extremely small, not much larger than a man's thumb, and this certainly is no reservoir. On the other hand, the symptoms complained of by patients who have had such an operation are minimal as compared with those complained of by the patients who have been subjected to a total gastrectomy. We are of the opinion that the reason for the paucity of symptoms in patients who have had a radical subtotal gastric resection is that there is less disturbance in gastrointestinal physiology than in total gastrectomy because at least some of the fibers of the left vagus are still intact.

Since it is obvious that the salvage rate of cancer of the stomach cannot be increased by doing more radical procedures, such as total gastrectomy, in all patients with gastric cancer, what can be done to increase the cure rate in this common disease? It is our belief that the salvage rate can be increased only by instituting therapy while the lesion is small and still is limited to the stomach, in order that it can be completely removed. In order to accomplish this, we believe that we must treat cancer of the stomach when we cannot diagnose it. Although this seems paradoxical, it means that lesions which are not clinically gastric cancer should be operated upon and treated as though they were malignant lesions.

Gastric polyps are definite premalignant lesions and should be treated by extirpation. Cromer and associates,[10] in a series of 195 cases of adenomatous polyps of the stomach, found that 35 (20 per cent) were malignant. Because it is impossible to determine at what stage malignant change occurs in gastric polypi, all should be treated as if they were malignant.

Although not readily accepted as a precancerous lesion, it is our belief that persistent gastritis can be and frequently is a precancerous lesion. Konjetzny[18] believes that gastric cancers develop on the basis of chronic gastritis, which he considers a definite precancerous condition. He is of the opinion that 85 per cent of gastric cancers develop on the basis of chronic gastritis. Orator[23] believes that 80 per cent of gastric cancers originate from chronic gastritis. Similar views are held by Hurst[17] and Puchert.[25]

In addition to the treatment by surgical methods of gastric lesions which are not clinically cancerous but which persist and many times are precancerous, it is imperative that occasionally patients should be operated upon when nothing can be found objectively, the patient being suspected of having carcinoma of the stomach simply because of symptoms. Reference is made particularly to men past 40 years who previously were well and free from digestive symptoms and who for the first time develop digestive symptoms so severe that they lose weight. In our experience, one of the earliest symptoms of gastric cancer is anorexia with or without some associated abdominal discomfort. If the anorexia persists in spite of therapy, and if there is an associated weight loss, the patient should be suspected of having gastric cancer. Occasionally in such a person there are no positive laboratory findings; roentgenologic examination is entirely negative; gastroscopic examination is negative and there may be only a hypoacidity or even a normal acid content of the stomach. Although undoubtedly many would be reluctant to advise an operative procedure because of the nebulous symptoms described above, it is our belief that unless this procedure is followed, a certain number of cancers of the stomach will be allowed to progress to such a degree that nothing can be done.

As previously reported, we have had 4 patients with small lesions upon whom we have operated simply because they had symptoms. In each instance a very small gastric cancer was found, and we believe that radical subtotal gastrectomy cured them. As yet we have not operated upon such a person unnecessarily, and although we would be the last to condone an unnecessary procedure, we think this is one instance in which abdominal exploration should be done more frequently in order to avoid the error of waiting until the lesion can be diagnosed clinically, at which time it is likely to be hopeless from the standpoint of cure. Undoubtedly, if one adopts this philosophy, some patients will be operated upon unnecessarily, and yet there would be no hesitation on our part to tell the patient frankly, after completion of the operation, that he did not have a cancer of his

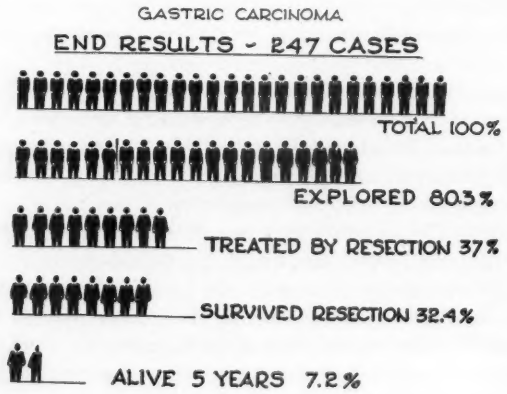

FIG. 24

stomach and, therefore, the operation had not been necessary. How much more fortunate he is than if the diagnosis had been correct and he had a malignant lesion of the stomach.

CONCLUSIONS

Carcinoma of the stomach still remains a real menace and relatively little is being accomplished as regards cure in this fatal disease.

More radical procedures such as total gastrectomy for all gastric cancers apparently are not the answer to the failure in obtaining better results because unfortunately the lesion is not diagnosed while it still is limited to the stomach.

In order to increase the salvage rates in gastric cancer it is imperative that therapy be instituted while the lesion is not diagnosable as cancer. This means that all patients with chronic gastric ulcers, gastric polypi, and certain persistent gastritides should be subjected to gastric resection. Furthermore, occasionally it is necessary to resort to abdominal exploration in men past 40 years who develop persistent gastric symptoms causing weight loss which do not respond to therapy, even though there is no laboratory evidence of gastric cancer (fig. 24).

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RESTORATION OF ARTERIAL CONTINUITY FOLLOWING SUDDEN INTERRUPTION: AUTOGENOUS GRAFTS; DIRECT ANASTOMOSIS; CASE REPORTS*

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An injury to a major artery is a very grave surgical emergency. Adequate therapy must be initiated efficiently, judiciously, and with minimum delay, if life and limb are to be salvaged, and the extremity restored to a functioning part. Janes,[3] in discussing this problem, has recorded four principles which the authors agree are basic: (1) do not delay; (2) do not elevate; (3) do not heat; and (4) do not refrigerate.

Following interruption of a major artery in an extremity, the circulation may be so seriously impaired as to require amputation. On the other hand, collateral circulation may be adequate and under proper treatment there may be no detectable abnormality after a few weeks.[1] It is difficult to decide between these two extremes when the patient first is examined after the catastrophe. Some authors state, particularly in upper extremity wounds, that the only therapy necessary is ligation of both ends of the severed vessel. This reasoning is based on the assumption that an abundant collateral circulation is present in the arm to compensate for the interruption of a major artery. We are not in complete accord with this view.

DeBakey and Simeone,[2] in reviewing arterial injuries in World War II, report the incidence of amputations following arterial severance (table I).

These results strongly support the view that an attempt should be made to restore the continuity of a severed artery, whether it be by direct anastomosis, or by the insertion of a venous graft. A small series is presented in which this principle was adopted. Amputation was not necessary in any patient.

DIAGNOSIS AND PRE-OPERATIVE TREATMENT

The diagnosis of arterial interruption is not difficult to make. However, it is difficult to differentiate severance from arterial spasm, contusion and concussion.

A history of a sudden onset is of paramount significance. Arterial insufficiency may result from an injury or an embolus. Four patients in this resume had a history of trauma. A fifth patient presented the picture of an embolus. Of the 4 traumatic cases, 3 were due to gunshot wounds, and 1 was caused by a stab wound.

A patient with arterial injury may or may not be in shock. It was our observation that blood loss was minimal, for which subsequent operative findings

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TABLE I

Location of Injury	Loss of Limb
	%
Axillary	43
Brachial above profunda	55.7
Brachial below profunda	25.8
Femoral above profunda	81.1
Femoral below profunda	54.8
Popliteal	72.5

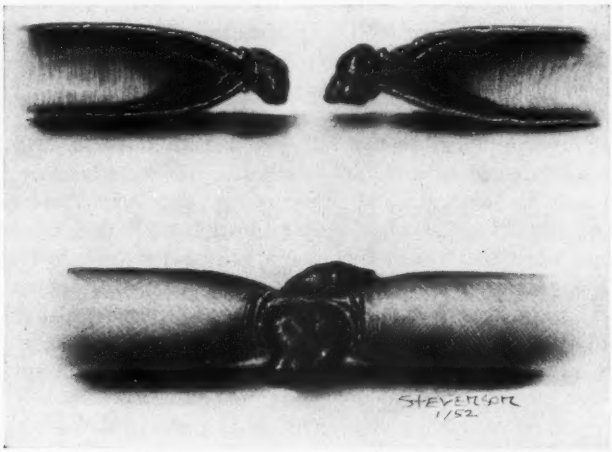

FIG. 1. The top figure shows a severed artery, in which the vasoconstriction and thrombus formation minimizes hemorrhage. The bottom figure shows a through and through perforation. The thrombus plug prevents complete vasoconstriction, thus, predisposing to hemorrhage around the periphery of the thrombus.

established a physiologic explanation. When a major artery is severed, spasm and contraction occur with rapid formation of a thrombus. In through and through perforations, our observations do not conform with the views of other authors. It has been stated that when a vessel is incompletely severed, effective or complete retraction is impossible, with resultant further opening of the perforation, and accentuation of hemorrhage (fig. 1). In the 3 cases of perforation which we encountered, early dark red thrombi occluded the openings, and the vessels were in spasm, thereby tamponing the lumens.

The affected extremity shows striking physical findings. Typically, the extremity is cold, clammy, and pulseless. The nailbeds are cyanotic. A pulse cannot be obtained distal to the injury. The oscillometer and the thermocouple, while unessential, are of diagnostic aid. In an extremity with the major blood supply interrupted, the oscillometric index will be zero. The skin temperature of the involved extremity is decreased in comparison to the uninvolved one.

The possibility of concomitant nerve injury should be considered. In upper

extremity injuries, the radial nerve is most commonly involved. In this series, the radial nerve was involved in 2 of 3 upper extremity injuries. In 1 case of radial nerve injury, the median nerve also was involved.

Roentgenologic examination is important in order to exclude the possibility of a fracture.

Procrastination is potentially detrimental. Operative intervention within an eight hour period should be instituted. Shock, if existent, should be treated by the administration of blood or plasma. Tetanus toxoid or antitoxin serum should be given.

A stellate ganglion or paravertebral sympathetic block, using 1 per cent procaine, should be done immediately. We favor the anterior approach in doing a stellate block, as follows: With the patient's head turned toward the opposite side, and after routine surgical preparation, one palpates for the transverse process of the sixth cervical vertebra lying just above the clavicle. A no. 20 spinal needle is inserted just posterior to the sternocleidomastoid muscle until the transverse process is encountered, the point of the needle then is directed along the transverse process until the body of the vertebra is reached. The needle then is withdrawn about 2 mm. and 10 cc. of 1 per cent procaine is injected. The appearance of a Horner's syndrome within five minutes indicates a successful block.

The use of a Levine tube to aspirate the stomach pre-operatively, and to minimize the possibility of vomiting and aspiration during induction of anesthesia, is strongly advocated. An endotracheal anesthetic is preferred.

OPERATIVE PROCEDURE

A longitudinal incision is made with its midpoint over the suspected site of arterial injury. The artery is exposed and mobilized proximal and distal to the injury, and a cotton tape is placed around the vessel at these two points as a safeguard if hemorrhage should occur. The artery is widely mobilized because of retraction of the vessel when it is divided. Extreme care should be observed in preserving all tributaries and none should be ligated except those which interfere with the anastomosis. The adventitia on each side of the injury is infiltrated with 1 per cent procaine hydrochloride to relieve spasm, and bulldog artery clamps are applied proximally and distally. If the vessel has been traumatically severed, the ends will be ragged. They should be transected evenly. If a through and through perforation has occurred, the perforated portion must be excised, extreme care being exercised in the length of artery removed. The adventitia should be stripped with fine tissue forceps for a distance of 1 cm. from each end. This is done to minimize the chance of thrombus formation at the site of the anastomosis, and also to partially denervate the local segment of artery involved. By means of traction on the bulldog clamps the two ends are approximated. If the two ends do not approximate without undue tension, it is wise to use an autogenous venous graft to bridge the defect. In the case of the brachial artery, if the forearm is flexed, additional relaxation may be obtained. If a primary end to end anastomosis is the procedure to be used, both ends of the

FIG. 2. Showing the technic of triangulation, the method of anastomosis in an autogenous venous graft, and adventitial stripping. The insert emphasizes the importance of the retrograde insertion of the venous graft to overcome the action of the valves.

vessel are bathed in heparin solution. Three oiled no. 0000 black arterial silk sutures are placed at equal distance around the circumference of the vessel to approximate the severed ends and to effect triangulation, care being exercised against traumatizing the intima with instruments (fig. 1). The advantage of triangulation lies in the fact that a flat surface is obtained on three sides, thereby permitting the insertion of the sutures with minimal constriction of the lumen. Following the above procedure, interrupted everting mattress sutures of no. 0000 black silk on an atraumatic needle are inserted on all three sides (figs. 2, 3). The three triangulating sutures are then tied, the distal bulldog clamp is removed first, and finally the proximal clamp is removed. Most seepage of blood will stop spontaneously or can be controlled by the application of gelfoam. A second adventitial injection of procaine hydrochloride is advisable.

If a vein graft is indicated, the saphenous vein is the most acceptable. The medial aspect of one thigh is prepared and a long segment of the saphenous vein is removed. The length then is fashioned to coincide with the defect in the artery

FIG. 3. Showing a completed anastomosis with the stripped adventitia and the polyethylene catheter in place for subsequent intra-arterial instillation of heparin.

and it is promptly bathed with heparin solution. The distal end of the vein is anastomosed to the proximal end of the artery, using the technic described above. It is of utmost importance that the vein be reversed to compensate for the valves which invariably are present.

If it is desired, a small opening is made in the artery, proximal to the anastomosis, and a fine polyethylene tube is inserted through this opening down to a point just proximal to the anastomosis. It is secured in the vessel with a purse string suture of fine silk placed in the adventitia. This tube serves as an avenue for subsequent continuous intra-arterial heparin. This assures the suture line of a continuous high concentration of heparin and further minimizes the chances of a thrombosis (fig. 3).

The wound is bathed with warm saline solution and meticulously inspected for bleeding points. A penrose drain is inserted and the wound then closed with interrupted cotton or silk sutures. A loose nonconstricting sterile dressing is

applied. A posterior splint is applied to obtain immobilization, and also to prevent undue tension upon the anastomosis.

POSTOPERATIVE TREATMENT

Postoperative care of the patient begins in the operating room at which time he is given 50 mg. of heparin intravenously. A clotting time is obtained immediately. If intra-arterial heparin is to be used, this is begun under pressure, which must excede the patient's systolic blood pressure. If a pressure apparatus is not available, continuous intravenous heparin, using 200 mg. of heparin in 500 cc. of physiologic sodium chloride solution, should be given by slow drip. Clotting times are obtained at four hour intervals by the Lee-White three tube method, maintaining the clotting time between 30 and 60 minutes. Three hundred milligrams of dicoumarol are given initially and prothrombin levels are checked in 24 hours. As an adequate prothrombin time is obtained, (30 to 35 seconds), heparin is withdrawn gradually until the patient is maintained on dicoumarol. Usually this cycle covers three days.

We believe that the use of an antibiotic is beneficial in these patients because the wounds are contaminated as a result of the initial injury. Chloromycetin and aureomycin are the drugs of choice because of their wide spectra. They first are used intravenously and later changed to oral administration as the patient's condition permits.

The extremity is placed in a slightly dependent position. Stellate ganglion blocks are continued for the first three days postoperative at 12 hour intervals. If the lower extremity is involved, and lumbar sympathectomy has not been done, paravertebral blocks are indicated at 12 hour intervals. A vasodilator, such as tetraethyl-ammonium chloride, may be given in doses of 0.5 gm. every four hours.

Extremes of heat or cold are detrimental to an extremity in which the blood supply has been impaired. Therefore, the use of either heat or cold is strongly contra-indicated.

COMPLICATIONS

Gangrene with subsequent loss of the limb is the most feared complication. In our small series of 5 cases, this complication was not encountered. The most common complication encountered was a hematoma in the wound which occurred in 4 patients. In 2 of these patients, a secondary wound repair was necessitated. We attributed this complication to rapid heparinization in the immediate postoperative period. The only other complication was a mild causalgic phenomenon observed in an 89 year old white woman. This was adequately controlled by the oral administration of priscoline.

CASE REPORTS

Case 1. J. M., an 18 year old Negro man, was admitted to the hospital on July 2, 1950 with gunshot wounds of the right axilla, chest, and right leg. The entire right arm and hand were cold and pulseless. A wrist-drop was present. The oscillometer index was 0. There was also evidence of both radial and median nerve involvement. A right stellate ganglion

block was done, and 1500 units of tetanus antitoxin were given. Shock was treated and the right axilla was explored. Endotracheal anesthesia was used. A through and through perforation of the right brachial artery was found proximal to the profunda branch. The injured segment was excised and the defect was bridged with an autogenous vein graft from the right saphenous vein. The radial and median nerves were sutured. Within eight hours postoperative the hand became warm. A pulse was obtained in seven days. He was discharged on July 17, 1950. The radial and median nerve functions gradually returned. When last seen, on April 22, 1952, the radial pulse was excellent. He offered no subjective complaints, and had returned to work as a laborer. The only residuum noted was atrophy of the thenar eminence. The function of the hand was perfect.

Case 2. R. S., a 35 year old Negro man, was admitted to the hospital on Nov. 19, 1950, approximately one hour after having been shot in the left thigh. He was in shock with a blood pressure which registered 50/0. There was a wound of entrance over the anterior medial aspect of the upper thigh. No wound of exit was noted. The entire leg was cold, pulseless, and the nailbeds were pale. The oscillometer index was 0. Shock was treated with plasma and 1500 units of tetanus antitoxin were given. A left lumbar paravertebral block was done. At operation a left lumbar ganglionectomy was done. Following this, the left femoral artery was explored and a through and through perforation of the left superficial femoral artery was found about 3 cm. below the profunda branch. The injured segment was resected and an end to end anastomosis was done. Immediately following operation, the leg and foot became warm. The posterior tibial pulse returned on the second postoperative day. The dorsalis pedis pulses was noted on the fifth postoperative day. A hematoma developed in the wound which resulted in a dehiscence requiring secondary closure. He was discharged on Jan. 26, 1951. When last seen in September 1951, he was completely asymptomatic. Pulsations in the foot were normal. He has returned to work as a laborer.

Case 3. B. W., an 89 year old white woman with arteriosclerosis and hypertension, was in her seventeenth postoperative day convalescing from a cholecystectomy. While sitting in a chair, combing her hair, she suddenly experienced an excruciating pain in her entire right arm. It became cold, pulseless, useless, and quite pale. An axillary pulsation could be felt. An oscillometer was applied and in the uppermost portion of the arm an index of 4 was noted. Immediately below this point, and in the remainder of the arm, an index of 0 was noted. A diagnosis of embolism of the right brachial artery was made. A right stellate ganglion block was done without improvement. Using procaine brachial block and sodium pentothal anesthesia, the right brachial artery was explored. At a point 4 cm. below the profunda branch, the artery was acutely angulated upon itself and occluded by a large arteriosclerotic plaque. No embolus was noted. Pulsations were excellent down to this point, but none were noted distally. This segment of artery was resected and an end to end anastomosis was made. Pulsations then were noted distal to the anastomosis. A small polyethylene tube was inserted into the artery proximal to the anastomosis for subsequent intra-arterial injections of heparin. Postoperatively the hand became warm in 12 hours. The radial pulse returned on the fourth postoperative day. Her convalescence was complicated by a hematoma of the wound which responded to treatment by evacuation. She was discharged on the twenty-first postoperative day. She has been quite well except for a moderate causalgic effect which has responded well to priscoline given orally. She was seen last on May 16, 1952. At that time the radial pulse was excellent and she was well except for slight weakness and moderate fatigability in the right arm and hand. The blood pressure reading in the right arm was consistently 5 to 10 mm. Hg lower than in the left.

Case 4. C. B., a 9 year old Negro boy, was brought to the hospital on Nov. 18, 1951, with a stab wound of the right axilla of 15 minutes duration. There was a small puncture wound in the apex of the axilla with blood spurting from it. No pulsation could be felt below the wound and the hand was cold and cyanotic. The oscillometer index was 0. Sensory and motor functions were intact. At operation the brachial artery was exposed and found to be completely divided. The proximal segment had retracted and the adventitia was partially holding a clot in place. An end to end anastomosis was done. The patient was placed

on heparin and dicoumarol postoperatively. The extremity became warm following operation, and a definite radial pulse was noted on the fourth postoperative day. The only complication was a small hematoma in the wound. He was discharged on the sixteenth day following operation. When last seen, May 9, 1952, he was doing well, and the radial pulse was present. The function of the extremity was normal.

Case 5. R. I., a 31 year old Negro man, was admitted to the hospital on Jan. 22, 1952, approximately four hours after having been shot in the left upper arm with a .32 caliber pistol. The bullet entered the upper end of the triceps and traversed the arm and made its exit through the upper one-third of the biceps. He had severe pain in the entire arm. He was not in shock. The arm was cold, clammy and pulseless. The nailbeds were pale. A wrist-drop was present and median sensory loss in the hand was noted. The motor component was intact. The oscillometer index was 0. A left stellate ganglion block was done. He was given 1500 units tetanus antitoxin. Fracture of the humerus was excluded by roentgenogram. The brachial artery was explored. A through and through perforation of this artery was found 2 cm. above the profunda brachii. The involved segment was resected and, in order to bridge the resultant defect a left saphenous vein graft was inserted. The median and ulnar nerves were intact, but contused. Because of the difficulty of the approach, it was deemed advisable to postpone radial nerve exploration for eight weeks. Postoperatively, the hand became warm immediately, and after 10 hours, an excellent radial pulse was noted. His postoperative course was complicated by a hematoma which was evacuated. He also developed severe neuritic pain and paresthesias in the hand and arm, limited to the distribution of the median and radial nerves. Eight weeks postoperative, the median and radial nerves were explored. Neuromas of both nerves were excised and a neurolysis was done. There has been subjective relief, and under physiotherapy, he has regained about 20 per cent return of function of the median nerve. A *cock-up* splint is worn. Radial pulsation is full and bounding. The blood pressure reading in the left arm is consistently 8 to 12 mm. Hg lower than in the right.

SUMMARY

Five cases of arterial injury are presented in which a standardized regimen was instituted with re-establishment of the circulation and salvage of the extremities.

Four cases involved the upper extremity. In 2 cases the lesions were due to gunshot wounds. One case was caused by a stab wound. The fourth case was the result of occlusion by an arteriosclerotic plaque in a tortuous brachial artery. The fifth case was secondary to a gunshot wound of the left superficial femoral artery.

Of the 4 cases involving the upper extremity, 2 patients were treated by primary end to end anstomoses, and 2 by venous grafts. The fifth patient showed involvement of the femoral artery, and was treated by end to end anastomosis.

It is concluded that, if doubt exists as to the patency of a major artery after injury, immediate exploration is indicated.

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RADICAL RESECTION VERSUS LOCAL EXCISION FOR MALIGNANT POLYPS OF THE COLON AND RECTUM*

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Many of the features of colonic polyps have been clarified in recent years, and there is general agreement that even the benign polyps should be treated as premalignant tumors. From a histopathologic viewpoint every stage in transition from adenoma to adenocarcinoma can be identified,[10] and it is necessary that surgical treatment of a given lesion be based upon an understanding of the particular phase of transition at the time of treatment.

Unfortunately many of the published reports of series of malignant polyps do not specify the extent of malignancy nor the criteria upon which the diagnosis is based; recommendations for treatment consequently are not specific. There seems to be no valid argument against treating carcinoma in situ arising in a polyp by adequate local excision of the polyp, and we have found no cases of recurrence or metastasis following such treatment. Conversely, there are few who would question the indication for a radical operation in the management of frank adenocarcinoma. The main controversy appears to be over the treatment of the tumor between these extremes, the adenoma of the colon with a microscopic area of carcinoma invading the basement membrane, or penetrating the muscularis mucosae into the submucosa. If the line of local excision is wide of the area of microscopic invasion, has treatment been adequate? If a polyp of this nature is found in the rectum, is abdominoperineal resection necessary, or if it is located higher in the colon should partial colectomy be done?

REVIEW OF LITERATURE

Attempts to answer the above questions appear in the literature, but few are based on statistical studies of long term follow-ups, and various criteria are used in deciding the extent of surgical treatment required. Hawthorne[9] advises abdominoperineal resection if malignant changes in a rectal polyp extend into the stalk; otherwise local excision and fulguration of the base are considered adequate provided frequent examinations are made subsequently. Turell and Wilkinson[19] advise radical surgery if there is any evidence of invasion. Bacon and associates[1] recommend the radical operation for polyps showing any malignant change, regardless of the extent of invasion. Cattell[3] has observed that the specimens obtained by radical operation following local excision of malignant polyps have not, in his experience, revealed any more tumor cells. He considers local excision plus careful follow-up study adequate, with abdominoperineal resection indicated if

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The opinions and conclusions expressed in this paper are those of the authors and are not to be construed as official or necessarily reflecting those of the Medical Department of the U. S. Navy, or of the Naval Service at large.

there is a local recurrence. DeMuth and co-workers[5] recommend radical operation if evidence of invasion is found by the pathologist.

Binkley and associates[2] have been following a series of 265 patients who have had polyps excised at Memorial Hospital in New York. In this group there were 39 malignancies, of which 23 were carcinoma in situ and 16 were invasive. Although there were no recurrences following local removal, 12 of the follow-ups were for less than three years.

Colvert and Brown[4] followed a series of 175 rectal polyps for five years; 36 of these had early signs of malignancy, and 16 demonstrated invasion of the tumor cells beneath the basement membrane. Fourteen of this latter group were followed for five years following local excision; there was no evidence of recurrence in 13, and 1 died of carcinoma of the rectum, although it was never ascertained whether this was a recurrence at the site of the original tumor.

Swinton[18] reported in 1948 a series of cases of 22 patients with early malignant changes in polyps treated by local excision, with no recurrences up to seven years. He did not specify how many of these tumors exhibited invasion. A later series from the Lahey Clinic[12] summarized 33 cases of pedunculated polyps with malignancy in the body or tip; these were excised with a broad base of mucosa and followed annually, with no recurrences.

On the other hand, several authors have analyzed their material and found an incidence of recurrence considered by them sufficient to indicate that local excision is not adequate treatment for these lesions.

McLanahan[15] followed a series of 38 malignant polyps of the rectum, of which 15 were invasive, treated by excision through the sigmoidoscope. There were 6 recurrences, all of which appeared within two years; 5 of the recurrences were frank cancer and responded well to radical surgery. This high recurrence rate is at variance with the experience of most others. McLanahan believes that conservative surgical management of the malignant polyp is justifiable only if there is no evidence of invasion, and provided that a very careful follow-up is maintained. In a discussion of the foregoing paper, it was the opinion of Harvey Stone[15] that reoperation is not indicated if the pathologist finds evidence of invasion in a specimen removed by colotomy, provided that frequent follow-up studies are made.

Scarborough[17] reported 326 polyps removed through the sigmoidoscope, of which 13 were malignant with microscopic evidence of invasion. Of this group of 13 patients, 9 had radical resections and 4 had local excisions of the polyps. In the radically resected group, 3 of the specimens contained residual carcinoma in the perirectal tissue or regional lymph nodes. In the group of 4 patients treated by local excision of the polyp, 1 had a local recurrence and the other 3 had no recurrences after two years.

In a later review, Klein and Scarborough[11] reported 100 cases of polyps of the colon which were above the sigmoidoscopic level, of which 23 demonstrated malignancy with invasion of the basement membrane or muscularis mucosae. There were 12 cases in which the polyp was reported benign on frozen section study, but in which malignancy was demonstrable by paraffin sections; local

excision was considered sufficient, in preference to reoperation for segmental resection, and all 12 patients were well for periods of from 1 to 11 years. There were 11 patients in whom the polyps were proved to be carcinomatous by frozen section, and in each instance a radical segmental resection was done immediately. Subsequent examination of the resected specimens proved that 5 of the 11 patients had regional lymph node metastases, although in no patient was there invasion of the pedicle by the carcinoma.

Fisher and Turnbull[7, 8] reported 21 malignant polyps which were removed through the sigmoidoscope, of which 14 were carcinoma in situ or superficial carcinoma, and 7 showed penetration into the submucosa. Although there have been no recurrences following local excision plus radium implantation, the authors imply that abdominoperineal resection is a better operation for invasive lesions, depending on operative risk and the patient's attitude.

In a series of 322 patients with polyps of the colon and rectum treated at the Massachusetts General Hospital,[20] there were 34 who had local excision of polyps containing invasive carcinoma. Nine had subsequent metastases or died of their malignancy. The authors recommend segmental resection as the proper procedure for routine use in the therapy of polyps of the colon—benign or malignant. For rectal polyps they advocate radical resection if there is microscopic evidence of invasion.

Lockhart-Mummery and Dukes[14] have proposed that the grade of malignancy be considered, as well as the extent of invasion, in determining the indications for radical surgery. In 24 patients with low grade malignancy treated by local excision there were no recurrences. In 20 patients exhibiting average invasive malignancy there were 9 recurrences following local excision, although only 1 of these recurrences was in a patient in whom the local excision was sufficiently wide to ensure an adequate free margin. There were 3 cases of high grade malignancy, and in each instance a local recurrence took place. These authors concluded that a clinicopathologic correlation should enable one to predict with more certainty the results from a given procedure.

MATERIAL AND RESULTS

From the preceding review of the literature it is apparent that there is no uniformity of opinion as to the proper treatment for malignant polyps of the rectum and colon. No single reported experience has been great enough to provide significant figures for comparison of the results of local excision with those of radical resection. At the same time the criteria used in the classification of *malignant polyps* and those upon which treatment is based either are not stated or vary so widely as to make a collective review meaningless.

We have defined the malignant polyp, about which there is so much controversy in regard to treatment, as that rectal or colonic polyp which does contain a microscopic area of invasion of the basement membrane or muscularis mucosae, and which has been excised with a wide margin of benign tissue between the area of invasion and the line of resection (fig. 1 and 2). Carcinoma in situ is excluded on the one hand and frank adenocarcinoma on the other. Histologic grading of

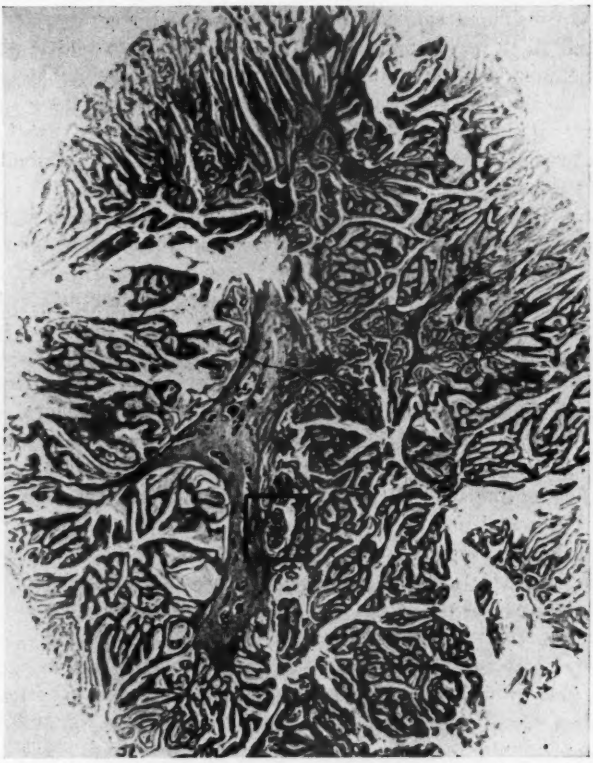

FIG. 1. Photomicrograph of a rectal polyp showing area of carcinoma with invasion of the submucosa of the pedicle. The malignancy does not extend into the base of the pedicle which is well below the microscopic field. (Low power, 10×, hematoxylin-eosin stain)

these tumors has not been attempted in our series but might prove important for future correlation studies.

In order to contribute additional data on the results following local excision of malignant polyps we have searched through our files at the National Naval Medical Center, Bethesda, Maryland, and through the records of the Armed Forces Institute of Pathology, Washington, D. C. We have been able to find only 8 rectal or colonic polyps of the type defined which were treated by local excision. A satisfactory follow-up was obtained in each instance; by this is meant a history, physical examination, sigmoidoscopy, and barium enema with air contrast studies (table I).

Follow-ups to date from 18 months to 4 years after local excision have revealed no evidence of recurrence in any of these 8 patients.

COMMENT

In our own series of malignant polyps of the rectum and colon which were treated by local excision the results have been uniformly good to date. Ad-

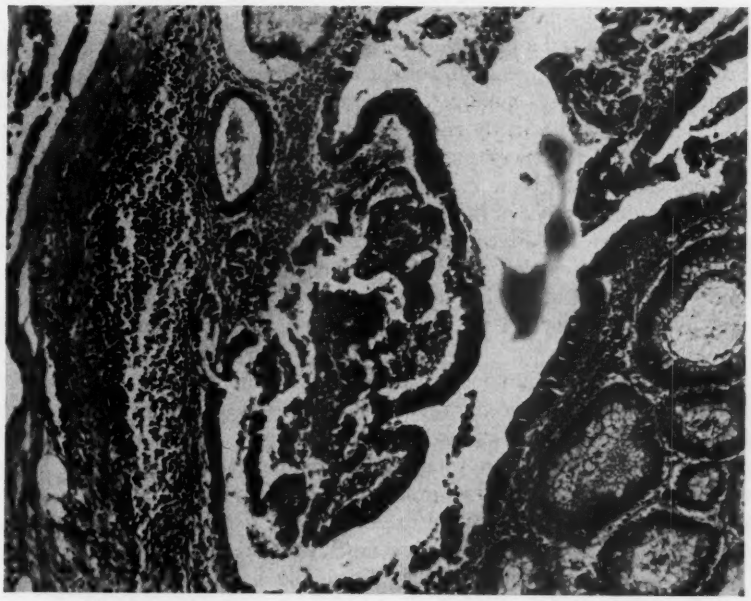

FIG. 2. High power magnification (120×) of the area in the inset of Figure 1, showing invasion of the submucosa by the carcinoma.

TABLE I

Patient's Age	Date of Operation	Site of Polyp	Route of Excision
76	1–4–49	sigmoid	colotomy
57	4–4–49	20 cm.	sigmoidoscope
66	8–19–49	sigmoid	colotomy
67	9–27–49	14 cm.	sigmoidoscope
58	3–13–50	20 cm.	colotomy
56	7–5–50	sigmoid	colotomy
68	2–2–51	rectosigmoid	colotomy
74	5–29–52	4 cm.	proctoscope

mittedly this series is too small and the duration of follow-ups too short to warrant any final conclusions. A continuation of the study is contemplated. In the meantime it is hoped that this report will stimulate others to contribute toward the answer to this very important question. When polyps which show only microscopic areas of invasion of the submucosa are separated from carcinoma in situ or frank adenocarcinoma, the total number of cases coming within the experience of any individual is apt to be small. This emphasizes the necessity for further study and accurate reporting of those cases of patients who had malignant polyps and were treated by local excision in order that significant figures on the results following this type of therapy may be collected for comparison with those following radical resection.

How may we justifiably obtain further data on this subject? A the present time a patient who has had a malignant polyp removed through a sigmoidoscope may be advised by some surgeons to submit to an abdominoperineal resection of the rectum, and by others merely to have a periodic examination. The evidence available seems insufficiently conclusive to justify the employment of a radical cancer operation for every malignant polyp exhibiting a microscopic area of invasion. Conversely, there is no secure basis for the adoption of wide local excision as a uniform mode of therapy. It is difficult to reconcile the reports of those who have had few or no recurrences following local excision[2, 4, 8, 12, 18] with those relating an appreciable incidence of recurrence.[11, 14, 15, 17, 20] Certainly the technic and extent of local excision must be considered, and unless there is a wide free margin beyond the site of invasion, excision cannot be considered adequate.

The polyp of the rectum presents a slightly different problem from the polyp of the sigmoid or remaining colon that cannot be reached through a sigmoidoscope. In the first place, radical extirpation of the rectum with permanent colostomy is a more formidable procedure than a segmental colectomy for a tumor higher in the colon, and hence might require a more unequivocal indication. Second, it is easy to visualize the site of local excision in the rectum for evidence of recurrence, whereas the barium enema is a much less satisfactory means of detecting a recurrence higher up in the colon. Third, the circumstances of removal of a polyp from below are such that more radical treatment would require an additional major operation, while colectomy for a malignant polyp removed by colotomy and local excision would require only a moderate extension of the scope of the operative procedure already in progress. For these reasons it seems reasonable to discuss the treatment of the lesions of the rectum separately from those in the remainder of the colon.

When a malignant polyp has been removed from the rectum by what appears—after careful study of the specimen—to be a wide local excision, it is difficult, in the light of the above considerations, to urge radical surgery. However, in the absence of complicating contraindications, this probably should be done. On the other hand, if immediate frozen section study of a locally excised polyp of the colon demonstrates invasive malignancy, it places little additional strain on either the surgeon or the patient to proceed with segmental resection of the involved bowel and its mesentery. The problem in malignant polyps of the colon arises when the diagnosis of malignancy is not made until serial paraffin sections are studied several days after the polypectomy. As with malignant rectal polyps the recommendation for further radical surgery becomes a difficult one but, if one is to be consistent, it probably should be made.

CONCLUSION

Even with the plan of treatment outlined, it can be seen that further study of local excision in the treatment of malignant polyps of the colon and rectum still is possible using those patients who refuse radical surgery or for whom it is believed that the hazards of a radical operation, or reoperation, weigh more heavily than the risk of recurrence.

A plea is made for continued evaluation of these cases with criteria for diagnosis sharply defined, with the adequacy of local excision measured by careful microscopic study, and with frequent and complete postoperative follow-up examinations. Only if this is done will it be possible to prove or disprove what one may strongly suspect: that the results obtained by wide local excision of malignant polyps of the colon and rectum compare favorably with those of the more radical surgical procedures, particularly if the increased morbidity and mortality rates of the latter are taken into account.

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UNEXPECTED CANCER OF THE THYROID*

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There is an increasing interest in cancer of the thyroid as shown by the increasing number of cases reported. We have noticed in our clinics, that there is a decreasing number of patients with toxic diffuse goiter and an increasing number of patients with nodular goiter who are being referred for surgical treatment. In view of these facts, and because from the Eastern seaboard two papers[6, 7] were published, a short time ago, which minimized the dangers of thyroid cancer and which advised against the prophylactic removal of nodular goiter, it seems fitting that a stand be taken concerning the treatment of this type of thyroid disease. The conclusions that were drawn by the authors of these two papers were based upon autopsy figures gathered from two large hospitals in Boston and one in Baltimore. It was reported that the incidence of patients dying of cancer of the thyroid was 1 to 1000 in 11,000 autopsies and it was, therefore, assumed that this represented the incidence of carcinoma occurring in the thyroid throughout the population served by these large medical centers. One of the objects of this paper is to point out the fallacy of these figures from a clinical standpoint and to disprove such conclusions.

Cope, Dobyns, Hamlin and Hopkirk,[2] working in the Thyroid Clinic in the Massachusetts General Hospital, studied the incidence of cancer of the thyroid in that clinic for a 12 year period from 1937 through 1948. The malignancies were divided into three groups:

I. Carcinoma found in toxic diffuse goiter.
II. Carcinoma found in nodular goiter.
III. Carcinoma found in single thyroid nodules.

The criteria for determining malignancies was as follows:

I. The lesion must have invaded the capsule and adjacent tissue.
II. It must have spread to lymph nodes, bone or other organs.
III. The so-called benign metastasizing lesion was considered to be malignant if—and only if—distant metastases were found.

They did not consider papillary cyst adenoma without such invasion, nor cases in which there were blood-vessel invasion alone, as being malignant.

The results of their studies were as follows: 0.8 per cent of carcinoma were found in 75 cases of toxic diffuse goiters; and 10.1 per cent were found in all cases of nodular goiter, regardless of multiple or single nodules. They also found 12 cases of malignancy which had metastasized to the thyroid from other organs.

Metastases to the thyroid gland from carcinoma of the colon, kidney, lungs, esophagus, trachea, and the thyroglossal tract have been reported.

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Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

Between the years 1944 and 1949 every patient who came to the Thyroid Clinic at the Massachusetts General Hospital and who had a single nodule in the thyroid or who had the disease localized to one portion of the thyroid gland with the remainder of the gland normal to palpation, was operated upon. Of the first 76 cases, 17, or 22 per cent, showed the lesion to be malignant. When this unselected series amounted to 156, 29, or 19 per cent, were proved malignant.

Cole[1], in Chicago, reported in 1945 that 17.1 per cent of all the patients operated upon for nontoxic nodular goiter were reported as malignant. Because this figure seemed unusually high he studied all cases of patients with nontoxic nodular goiter who were operated upon between the years of 1945 and 1949 and found almost exactly the same percentage of malignancy, viz: 17.2 per cent.

Realizing that the incidence of cancer in goiter varies according to the geographic location and according to the type of goiter most prevalent therein, it is interesting to note that, from California, the late Mayo Soley,[7] in a paper read before the American Goiter Association in 1945, stated that in 96 consecutive patients having solitary thyroid nodules—16 per cent proved to be malignant. The incidence of cancer in nodular goiter from the Eastern seaboard, from the middle West and from the far West, therefore, is respectively 19 per cent in Boston, 17 per cent in Chicago and 16 per cent in San Francisco. It probably is true, however, that these figures do not represent the actual incidence of cancer in nodular goiter as it exists throughout the country. Patients going to the large goiter centers already have been screened, first by themselves, because the goiter which may have been present for years gradually becomes larger or harder or produces pressure symptoms, and second, by the patients' physicians who, having observed the nodules for a period of time, eventually become concerned about changes taking place within them and then refer them to the thyroidologist. To a group of clinical surgeons the actual percentage of the incidence of cancer found in nodular goiter is of little importance. It is important, however, to know that cancer in thyroid nodules is far more prevalent than is generally realized.

The percentage of cancer found in goiters in children is alarmingly high. Kennedy,[5] in a paper read before the American Goiter Association in 1940, reported that he found cancer in 19.3 per cent in a group of 63 children under 14 years of age who were operated upon for goiter.

One reason, perhaps, for the increasing number of thyroid cancers reported is the fact that more nodular goiters are being operated upon and fewer toxic diffuse goiters are coming to surgery. This probably is due to the fact that many physicians and internists are treating more of the patients with toxic diffuse glands by the antithyroid drugs or radioactive iodine, whereas they are referring increasing numbers of nodular goiters for surgical removal. During the past 10 years, in one of our hospitals, there were nearly twice as many nodular goiters removed as compared to the previous 10 years; during this latter period 10 per cent of the thyroids showed cancer, whereas during the preceding decade only 3 per cent proved to be malignant. This would seem to indicate that the more nodular goiters removed the higher is the percentage of cancer found.

There are also increasing numbers of cancer of the thyroid reported by the pathologists which were not suspected by the surgeon at the time of their removal. Horn and Dull[3] recently have reported that out of 174 cancers of the thyroid found in a total of 1777 goiters removed, 78 were suspected of being malignant preoperatively whereas the remaining 96 were first diagnosed by the pathologist. These figures compare favorably with those from our own thyroid service and with those reported by many other authors. I do not think that this disparity between the expected and unexpected presence of malignancy is found in any other organ in the body.

In the group of cases studied at the Brooklyn Cancer Institute by the late Doctor W. E. Howes and Doctor Merrill N. Foote,[4] it was found that in the cases of nontoxic nodular goiter in which cancer was proved in this institution, there was a history that a mass in the neck had been present for an average of approximately five years before these patients came for treatment. It seems reasonable, therefore, to assume that many of these nodules began as benign tumors which eventually became malignant. It is, I believe, equally reasonable to assume that if these nodules had been removed when they were first noticed and before they were suspected of being malignant, the incidence of malignancy in this group would have been extremely low. It is interesting to note that in another group of patients in whom malignancy was not suspected at the time of operation, but was proved by histologic examination, the five year survivals approximated 80 per cent. Whereas, in a comparable, but somewhat smaller group, in which cancer was diagnosed or strongly suspected before operation, the five year survivals were approximately 20 per cent.

Horn and Dull reported that in 53 cases of patients with unsuspected cancer 83 per cent survived five years whereas in 59 patients diagnosed as cancer clinically only 37 per cent were alive at the end of six years. Probably the reason that only 20 per cent of our patients who were clinically diagnosed as having cancer lived five years—which is considerably lower than those reported by Horn and Dull—was due to the fact that our figures included the patients in the Brooklyn Cancer Institute who were referred to this institution in a much more advanced stage of the disease than would be found in the average general hospital clinics.

We have found that of our patients with cancer of the thyroid who survived five years and were free of the disease, that only one-half of these were alive and disease free at the end of the next five years. Therefore, the so-called five year cure does not apply to cancer of the thyroid. The follow-up study by Horn and Dull on 112 patients with thyroid malignancy of all types showed that 59 per cent survived five years, but that only 30 per cent were alive at the end of 12 years. These observations indicate that malignancy of the thyroid is generally of a low grade; developing and progressing slowly, and support the belief that all nodular goiters should be removed promptly after making the diagnosis.

For years an enlargement of the so-called Delphian node has been known to be a possible indication of cancer of the thyroid. This node which normally is not

palpable lies in the midline of the neck just above the thyroid isthmus and in front of the middle cricothyroid ligament. It frequently has been demonstrated to be so enlarged in cases of thyroid malignancy that it can be palpated before operation. It is easily dissected out at the time of thyroidectomy and might well be examined by frozen section before the resection of the thyroid is begun. It is true that frequently it is enlarged in cases of Hashimoto's disease, in toxic diffuse goiters and accompanying infections involving the thyroglossal duct. But if biopsy is positive for malignancy more radical surgery well may be considered at the time of the first operation.

The 5 following cases are illustrative.

CASE REPORTS

Case 1. Mrs. H., 50 years old, was first operated upon 34 years ago in Toronto, where a nodule was enucleated from the left lobe. Fourteen years later a swelling appeared in the left thyroid lobe. Eight years later—in 1942 which was 12 years ago—the second operation was done. While making the skin incision uncontrollable bleeding was encountered. As the operation progressed, there was so much oozing from every portion of the wound that it could not be satisfactorily controlled. A rapid and incomplete subtotal thyroidectomy was done. The bleeding continued and it was necessary to pack the wound in order to control it. Mattress sutures, closely placed failed to stop the bleeding in the skin edges which was controlled by a firm sponge compression dressing. The pathologist reported "Nodular goiter with no malignancy". The patient remained well with no evidence of residual disease except for the fact that small remnants of the thyroid could be felt on each side of the trachea. Seven years later—1949—the gland became larger and firmer and some pressure symptoms developed. Complete blood studies were done and no dyscrasia indicating abnormal bleeding could be found. With a continuous blood transfusion, a second attempt to remove the residual remnants was undertaken. In spite of a similar alarming hemorrhage a radical resection was done leaving a very small remnant on each side. Much to our chagrin, the pathologist now reported diffuse carcinoma throughout the tissue removed. The patient was given deep radiation therapy and radioactive iodine. She remained well for two years until 1951. Then a hard nodule appeared in the region of the left thyroid remnant. Blood studies again were reported negative. The patient again was operated upon. The same uncontrollable bleeding from the skin, muscles and the remnant of gland containing the recurrence complicated the operation. However, the tumor again was radically removed. There were no demonstrable nodes. The wound was packed with gelfoam gauze. The pathologic report was adenocarcinoma with the same cellular characteristics as reported at the previous operation. Another course of radiation therapy and radioactive iodine was given. A radioautograph now failed to reveal any uptake in the region of the left lobe. This was done three years ago. There was always a small firm mass in the area in which the gelfoam gauze was inserted. Eighteen months ago examination showed this mass to be a little larger. Whether this nodule was the reaction around the gelfoam or whether it was cancer was not known. In September of 1952 the tumor again was radically removed. The left laryngeal nerve was now sacrificed. At no time has there been any evidence of lymph node involvement. At the present time the patient is well and has no signs of residual malignant disease.

The reason for reporting this case somewhat in detail is to emphasize the fact that we believe that cancer developed in the remnant of the incompletely removed gland after the second operation in 1942, 12 years ago. I do not think it was present at that time because there was a period of seven years during which no changes in the gland appeared. In spite of surgery, radiation therapy, and radioiodine, recurrences have appeared at increasingly frequent intervals. I believe that if a proper resection could have been done at

the first, or even the second operation, at which time no cancer was found this patient would not have developed a malignancy.

Case 2. The second case is that of Miss D., a nurse, who had noticed a small lump in the left side of her neck for seven years. She asked several physicians about this lump and was given the all too common advice, "Don't bother it if it does not bother you". When she came to us seven years ago the entire thyroid was normal to inspection and palpation except in the lower pole in the left lobe where an apparently perfectly circumscribed benign nodule was found. A radical resection of this left lobe and the isthmus was done in 1947. Exploration of the superior mediastinum revealed what was, at first, thought to be another adenoma. Further examination, however, showed the entire upper mediastinum to be filled with a mass of lymph nodes which upon section were proved to be metastatic from this apparently innocent-looking nodule in the left lobe. All grossly involved tissue was removed. The operation was done seven years ago. Repeated courses of deep radiation therapy and radioiodine were given. The patient is hoarse due to recurrent nerve involvement, but otherwise is symptom free. There are no demonstrable mediastinal masses shown by roentgenograms. However, we believe that this patient probably has residual mediastinal cancer and eventually will succumb to it.

Case 3. The third case, Mrs. R., came because there was a very small lump, no bigger than an old fashioned shoebutton, which had been noticed one year previously in the middle of the isthmus of the thyroid. The patient was a laboratory technician and we rather apologetically urged that this nodule be removed. At operation, four years ago, extirpation of the entire isthmus and a radical bilateral subtotal thyroidectomy was done although we could find nothing except this innocent-looking and innocent-feeling solitary nodule in the isthmus. The pathologist, however, reported squamous cell carcinoma of the thyroid. Deep radiation therapy and radioiodine were given. The patient has remained well as far as the thyroid is concerned, but a year ago she had a right radical mastectomy for cancer of the breast. This was reported as "Comedo carcinoma of the right breast associated with Paget's disease of the nipple."

Case 4. The fourth case was a Negro woman, 57 years old, who for many years had a nontoxic nodular goiter involving both lobes of the thyroid. She came in primarily because it was unsightly and because there recently had developed very slight pressure symptoms. It looked like an ordinary so-called endemic goiter. A radical bilateral subtotal thyroidectomy was done and nothing unusual was noted at the operating table to make one suspicious of malignancy. However, after examination by the pathologist, he found within one of the many nodules, scattered throughout the thyroid, adenocarcinoma.

Case 5. This patient, Miss M. DeC. reported for examination because she had a great deal of *"abdominal gas"*, much belching, loss of 10 pounds in weight, marked nervousness, palpitation of the heart, sweating and tremor of the fingers. Even the presence of a goiter was not noticed by the patient nor was it considered of any serious consequence by the family physician.

Examination showed a bilaterally enlarged nodular thyroid gland. The clinical diagnosis was toxic nodular goiter. A complete gastrointestinal study showed no intrinsic disease. The basal metabolic rate was plus 22. The patient was prepared with Lugol's solution. Nine days later a subtotal bilateral thyroidectomy was done.

A greatly enlarged delphian node was found which immediately suggestfd the possibility of malignancy of the thyroid. In the upper third of the right lobe there was a very hard nodule with nondiscrete borders firmly fixed within the substance of the gland. In the lower third of the left lobe there were two firm discrete nodules which seemed to be well encapsulated. The pathologist reported carcinoma of the nodule in the right lobe and benign calcified adenoma in the left lobe. Figure 1 shows the gross pathology and the marked difference between the malignant tumor which is not raised up above the substance of the gland on sectioning whereas it does show that the non-malignant nodules stand out much as fibroids do from the substance of the uterine wall.

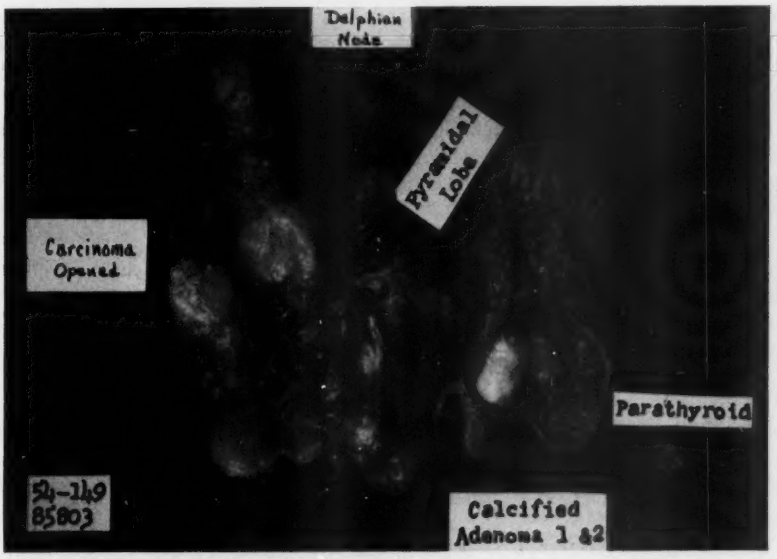

FIG. 1. Photograph of subtotally resected thyroid showing two main modules, the one in the right lobe has invaded and passed through the capsule of the nodule and has begun to involve the substance of the right lobe. The cut surface of this nodule is level with the substance of the gland. The nodule in the opposite lobe is well circumscribed and shows no invasive characteristics. The cut surface of this nodule, which is benign, stands up above the substance of the gland. This is a very important finding and is gross evidence of a benign lesion.

COMMENT

We have presented 5 cases of nodular goiter, none of which was suspected of being malignant at the time of surgery. Two patients had solitary nodules. I believe that 1 of these, the squamous cell carcinoma has a good chance of cure although sufficient time has not elapsed to be sure of this. I am very fearful that the malignancy in the second case of solitary nodular goiter with extensive mediastinal lymph node involvement is only temporarily controlled and will, eventually, terminate fatally.

The 2 cases of so-called generalized nodular goiter are of interest because in the first case the cancer probably developed in the remaining portion of the gland after the first incomplete operation was done. In the second case there was nothing to lead us to suspect malignancy. There were no local signs of invasion and, in view of the fact that the pathologist found invasion only after careful sectioning and found it in only one of the nodules, there is a good chance that this patient may be cured of her disease. Of course we realize that no conclusions can be drawn from 4 cases of this type. While we cannot be sure that the 2 hopeful patients will remain cured, it is fair to assume that if the one solitary nodule in the lower left lobe with metastases in the mediastinum had been

operated upon when first noticed—seven years before operation was done—and if the nodular goiter in the first case reported could have been properly extirpated at the first or even second operation, the chance of cure in these 2 patients would have been as good as those in the former 2.

Case 5 shows that thyroid nodules should not be enucleated. We believe that bilateral subtotal thyroidectomy should be done in all cases of nodular goiter even though the nodule or nodules may be confined to one lobe.

CONCLUSIONS

Cancer of the thyroid is a common and serious disease. It frequently developes within the initial and, often benign, lesion, years after it was first noticed.

Proper surgical extirpation is the procedure of choice and should be done in all cases of nodular goiter.

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ACHALASIA OF THE ESOPHAGUS*

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Achalasia of the esophagus may be defined as a nonorganic stenosis of the lower 3 to 6 cm. of the esophagus with dilatation and hypertrophy above. The term achalasia means failure of relaxation and was applied to this condition by Hurst in 1914.[5] There are many synonyms for this clinical entity. The one probably most used in cardiospasm which was first introduced in 1882 by von Mikulicz,[16] but it is a misnomer since the disease involves the esophagus and not the cardia.

The first case was described by Willis,[19] in 1672 and since that time the literature on this subject has become very extensive. Many theories concerning the etiology have been evolved, but still there is no general agreement as to the exact cause. This has resulted in a state of confusion, not only in regard to etiology, but to treatment as well. The theory which is appealing and deserves attention is the one which was first suggested by Hurst[6] in 1914, when he stated that the most probable cause of achalasia was the progressive degeneration of Auerbach's plexus. Rake[13] and others[7, 15] have confirmed this opinion after the study of many microscopic sections taken from the esophagus and stated that *there was a definite degeneration or absence of the ganglion cells in Auerbach's plexus.* This abnormality could be demonstrated not only in the stenosed area but also in the dilated esophagus. Puppel[12] also has shown that the whole esophagus is involved in the disease.

DIAGNOSIS

The cardinal clinical symptoms of this disease are dysphagia, regurgitation, and substernal pain. There is weight loss in the majority of patients, but may not be present in the early stage. Some authors state that the condition occurs more frequently in females than in males but, according to Palmer,[11] in a collected series of 626 cases, 53.3 per cent were in men. This disease has been reported as occurring in infants as well as in elderly people, but it occurs most frequently in the third and fourth decades of life. Fluoroscopic and roentgenographic examinations after a barium meal are the most important diagnostic aids. The lower 3 to 6 cm. of the esophagus will appear to be narrow, and above the stenosis the esophagus will vary in dilatation depending upon the stage of the disease. In the early state, the esophagus will have a fusiform appearance, but as time passes and the disease progresses it may become tortuous, elongated, and large enough to fill the entire right chest cavity. The tip of the dilated esophagus may be outlined as a nipple-like projection. Although the diagnosis can be made accurately by correlating the clinical symptoms and the roentgenologic findings,

* Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8–11, 1954, Birmingham, Alabama.

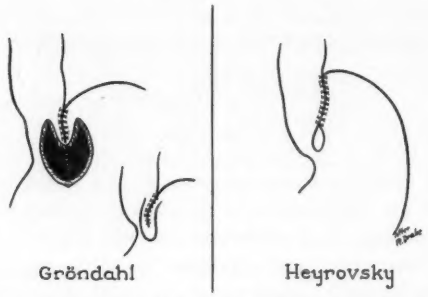

FIG. 1. Grondahl and Heyrovsky operative procedures

esophagoscopy should be done in every patient to rule out the possibility of carcinoma of the esophagus or cardia. Pneumonitis, bronchiectasis and lung abscess may develop as a result of nocturnal regurgitation.

TREATMENT

According to reports it seems that hydrostatic dilatation is the treatment of choice in the majority of patients with achalasia. Relief of dysphagia for from 4 to 16 years was obtained from a single series of dilatations in 60.1 per cent of 452 patients who were traced by Olsen and associates.[10] If his group had the opportunity of treating those patients a second time, for whom an initial course of hydrostatic dilatation did not permanently relieve dysphagia, the percentage of satisfactory results could be increased to 75 per cent. That leaves approximately 25 per cent of the patients, who can not be relieved permanently by dilatation, for surgical intervention. I believe, however, that as soon as more physicians realize that the mortality rate is little if any higher for surgical intervention, that more patients will be treated by operation initially before dilatation is done.

The surgical procedures which are used at the present time are as follows:

1. Esophagogastrostomy of Heyrovsky,[4] which is a side to side anastomosis between the esophagus and the fundus of the stomach (fig. 1).

2. Grondahl's procedure[2] is an anastomosis between the esophagus and cardia after a U shaped incision is made through the esophagus and cardia (fig. 1). This is based on the Finney principle of pyloroplasty.

3. In cardioplasty as advocated by Wendel,[18] an incision is made through all layers of the constricted portion of the esophagus and extended upward through the dilated portion and through all layers of the cardia. The incision is closed transversely (fig. 2). This is based upon the Heineke-Mikulicz principle.

4. In extramucous esophagocardiomyotomy, or Heller's technic,[3] an incision is made through the muscular layers of the esophagus and cardia down to the mucosa for a distance of 10 to 12 cm. (fig. 3).

5. Resection of the lower end of the esophagus and cardia, and esophagogastrostomy for the elongated, tortuous, tremendously dilated esophagus has been recommended.

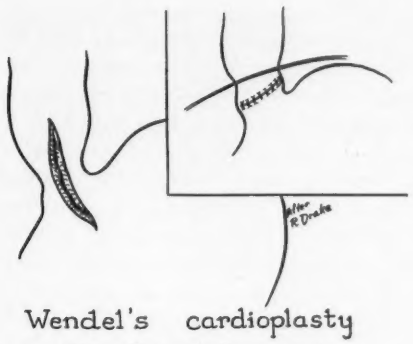

FIG. 2. Wendel's cardioplasty

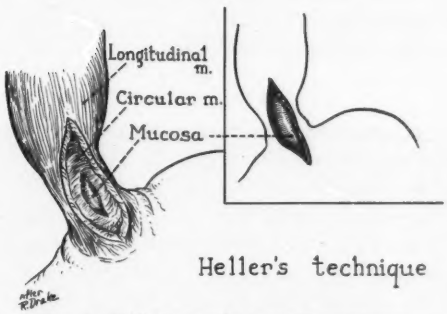

FIG. 3. Heller's esophagocardiomyotomy

TECHNIC OF THE WENDEL PROCEDURE

A left thoractomy is done through the seventh or eighth intercostal space and the constricted part of the esophagus and part of the dilated portion of the esophagus are dissected out. The diaphragm is opened at the hiatus for a short distance exposing the cardia. An incision is made through all layers of the constricted portion of the esophagus and a small portion of the dilated esophagus and is extended down through all layers of the cardia. Then the incision is closed transversely. After the anastomosis is completed, it is very important to suture the diaphragm to the esophagus above the anastomosis because this maneuver is thought to prevent post-operative regurgitation. Sweet[14] is one of the chief advocates of this procedure. He has stated that in 26 patients upon whom he performed an esophagoplasty,[15] 4 showed symptoms of esophagitis, 1 had slight hemorrhage, and 2 had massive hemorrhage requiring reoperation and radical resection. The results apparently were satisfactory in the remaining 22 patients.

HELLER'S TECHNIC OF EXTRAMUCOUS ESOPHAGOCARDIOMYOTOMY

The esophagus and cardia are exposed in the same manner as described in the Wendel procedure. The incision is made through the muscular layers of the

esophagus and cardia down to the mucosa for a distance of 10 to 12 cm.[17] The incision extends from the cardia to and includes several centimeters of the dilated portion of the esophagus. Several of the authors who advocate this procedure believe that the poor results reported previously by some authors are really due to the fact that the incision was not of adequate length. Originally, an incision was made on both the anterior and posterior surfaces of the esophagus and cardia. Later the anterior incision was found to be adequate. Wangensteen[17] used the Heller technic and prefered to make a short gastrotomy incision in the upper stomach. Then under visual and tactile control with the finger inserted into the esophagus, he divided the muscular fibers of the lower end of the esophagus and cardia without risk of injury to the mucosa. Maingot[9] has reported 38 of 39 patients cured by this procedure. Kay[7] used this procedure because of a 28 per cent incidence of regurgitation, esophagitis, and bleeding with other methods. Barrett[1] also has advocated this method and reported 10 good results in 11 patients. These authors believed it was a better procedure because it is not followed by regurgitation and esophagitis.

ANALYSIS OF CASES

Seven patients who had achalasia of the esophagus have been operated upon by the author. In the first 6, Wendel's technic was employed. Two representative cases are shown (figs. 4 and 5). All of these were done from one and a half to five years ago and to my knowledge there has been no report of regurgitation or esophagitis. The reason for these results probably is the small number of cases. Two of the patients were dilated a number of times elsewhere but the remaining

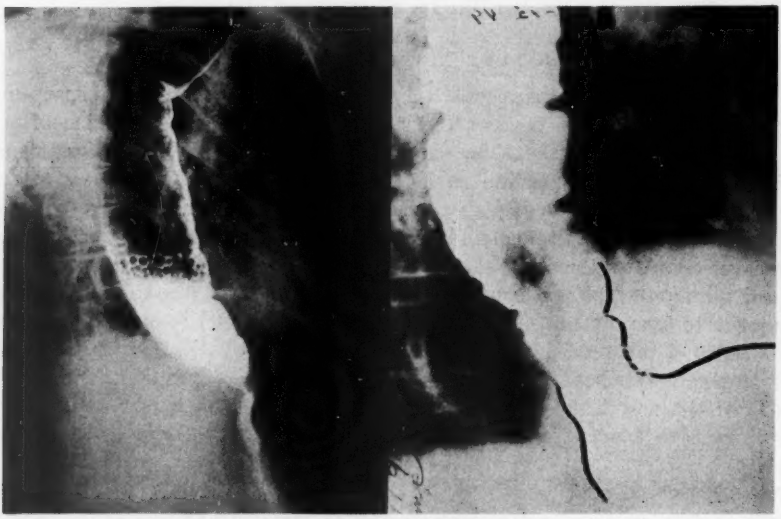

FIG. 4. A. Case of achalasia in a 72 year old woman showing dilated esophagus with constriction of lower end. B. After correction by Wendel's technic.

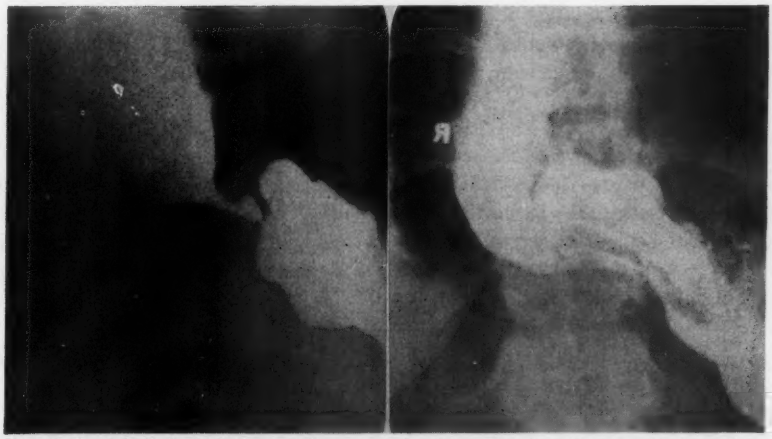

FIG. 5. A. Achalasia in 43 year old woman, showing stenosis at lower end of esophagus. B. After operation by Wendel's technic.

FIG. 6. A. Esophagram showing dilated esophagus with stenosis at lower end—infant 9 months of age. B. After Heller's technic. Postoperative esophagus showing decrease in size of esophagus and no obstruction at the lower end. (Courtesy of J. Medical Association of Georgia.)

five did not have dilatation. It is important to emphasize that, in those patients who are not relieved by preferably one or certainly two dilatations, surgery should be recommended. The seventh case was in an infant 9 months of age in whom Heller's technic was used because it appeared to be a simpler, safer, and more

satisfactory procedure (fig. 6). This case has been reported previously.[8] There has been no evidence of esophagitis or regurgitation in this child since operation. All patients in this series were females. There were no deaths.

SUMMARY

An appealing theory of the etiology of achalasia has been discussed. The operative procedures for achalasia of the esophagus have been listed with emphasis upon the Wendel and Heller technics. The author believes that more patients will be treated initially by operation before dilatation, and that the Heller technic should be used. An analysis of 7 cases has been presented with the types of operative procedures used.

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DIAPHRAGMATIC HERNIA*

A REPORT OF EIGHTY-THREE CASES

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The diagnosis of diaphragmatic hernia was rare until the past few years. With the advent of more thorough roentgenograms of the esophagus and stomach and the recent advancement of thoracic surgery, this diagnosis is not at all rare today.

Much has been written about the classification of diaphragmatic hernias. Some authors have classified them into traumatic and nontraumatic; some into congenital or acquired; and still others into true or false hernias.

Diaphragmatic hernia may occur at many locations. The vast majority occur at the esophageal hiatus. Other sites for these hernias are the foramen of Morgagni or parasternal foramen, and the foramen of Bockdalek. It also may result from the absence of the posterior leaf of the diaphragm. In traumatic cases, diaphragmatic hernia may occur at any location in the diaphragm.

The symptoms of diaphragmatic hernia are directly related to the herniated organ that is involved. For this reason, the symptoms may be divided between those in which only the stomach is herniated and those hernias in which other organs are protruded into the thorax. The first group in which only the stomach is involved usually is the hiatal hernia and the latter group usually is traumatic in origin.

ESOPHAGEAL HIATAL HERNIA

There are two types of esophageal hiatal hernias, the sliding and the paraesophageal.[6] In the sliding type, the esophagus is telescoped on itself. The intrathoracic portion of the stomach lies directly caudad to the lower end of the esophagus. It is this type that is impossible to differentiate from a true short esophagus on roentgenographic examination of the esophagus and stomach. The only means by which this sliding type of hiatal hernia and a short esophagus can be differentiated is by actually measuring the length of the esophagus during an esophagoscopic examination. The diagnosis of a short esophagus also should be questioned if there is no associated ulceration present. It is our belief that all patients with hiatal hernia should have esophagoscopy before doing any definitive surgery.

The paraesophageal type of hernia can be diagnosed by roentgenographic means. This type has a normal length of esophagus by such examination. The herniated portion of the stomach lies along the side of the lower end of the esophagus. There may be a combination of these two types of hernia.

The chief symptoms of the sliding hernia are heart burn, regurgitation of

* Presented during the Birmingham Assembly of The Southeastern Surgical Congress, March 8-11, 1954, Birmingham, Alabama.

gastric contents when lying down, and occasional severe hemorrhage[2] or the presence of a severe anemia from slow blood loss. In the paraesophageal type of hernia, the chief symptom is pain due to incarceration of the intrathoracic portion of the stomach.

Diaphragmatic hiatal hernia may be small and asymptomatic. However, it has been our experience that some small hiatal hernias may cause very severe symptoms. The size of the hernia certainly is no indication of the severity of symptoms.[3] If symptoms are present they are the result of intermittent incarceration of the stomach. A common symptom of hiatal hernia is that of pain following the ingestion of food which is relieved by belching or vomiting. These attacks may occur daily or may be months or possibly a year or so apart. When the patient reclines, his symptoms are made much more severe. If the hernia is large and causes some pressure upon the heart, the symptoms of tachycardia, palpatation, and shoulder pain may be predominant. As the hernia gets larger, the attacks become more frequent and are less easily relieved by belching or vomiting. So much difficulty is encountered following eating that food fear may be noted with the resulting loss of weight. Actually, it is not the type of food but the quantity of food that causes difficulties. On occasion, the hernia may give symptoms simulating gallbladder disease, gastric ulcer, or heart disease. It must be pointed out that the age group in which esophageal hiatal hernia gives the maximum of symptoms is between 40 and 70 years. It is also this age group of patients that are most prone to develop gallstones, gastric ulcers, and angina. At times, the determination of which organ is causing the symptoms is very difficult. Also, it is common to find disease present in two or more of these systems.

The diagnosis of esophageal hiatal hernia rests with the demonstration of the hernia by careful roentgenologic examination of the esophagus and stomach. The number of hernias that are found is in direct proportion to the ability of the roentgenologist and his diligence in examining each patient for the presence of a diaphragmatic hernia. It is our belief that no roentgenogram of the stomach and the esophagus is complete unless the patient's head has been lowered and every attempt made to demonstrate the presence of a hiatal hernia. If the first roentgenologic examination is reported to be negative for hernia and the symptoms are typical, we are justified in having this examination repeated. We frequently have seen that it is impossible to demonstrate a hiatal hernia on the first examination when we were certain that one was present. At times it is difficult to determine if the symptoms are due to a hiatal hernia or due to disease of some other system. We believe that it is helpful to have the patient sleep with the head elevated 18 inches for a few nights. Hiatal hernia usually are relieved by this single procedure; whereas, it will make no difference with the other diseases.

The treatment of esophageal hiatal hernia does not depend upon the size of the hernia, but upon the symptoms that it produces. If no symptoms are produced and the hernia is small, no treatment is necessary. Patients with hernia should be advised to lose weight if they are obese.

If mild symptoms are present, the symptoms can be controlled by the reduction of weight, multiple small feedings and sleeping with the head elevated from 15 to

18 inches. If the symptoms are severe or progressive, if more than one-fourth of the stomach is involved, or if any organ other than the stomach is involved, then repair of the hernia should be urged unless there is some definite contraindication to surgery. The repair of these hernias is most easily done by the transthoracic approach[4, 5, 6] and there is little risk involved in the well prepared patient. We have been using the technic as described by Allison[1] with very satisfactory results. If the patient waits until the stomach becomes incarcerated before having the surgery, the risk is considerably increased. In the incarcerated cases, the presence of a stomach tube is mandatory in order to prevent the aspiration of any regurgitated fluid when the stomach is suddenly released.

In the elderly or poor-risk patient, who is not relieved by the simple measures that have been mentioned, the crushing of the left phrenic nerve may give much symptomatic relief. This causes relaxation of the diaphragm and lessens the likelihood of incarceration of the stomach.

In the past four years we have repaired 60 esophageal hernias. Of this group, 48 were of the sliding type and 12 of the paraesophageal type. Only one death occurred. This was in a patient who developed a fulminating pericarditis that was unrelated to his operation.

The predominant symptoms of this group of patients is of particular interest (table 1).

Five had been diagnosed as having acute coronary occlusion and were referred to a cardiologist. The hernia then was diagnosed by the cardiologist and there was no evidence of coronary disease.

Four of this group had been diagnosed as having diseased gallbladders as the cause of their symptoms. The gallbladders were normal to palpation at the time of repair of the hernias.

Severe hemorrhage or anemia was present in 6 of the patients. Esophageal obstruction from incarceration was the chief symptom in 8 of the patients.

Thirty-five had the typical symptoms of pain following the ingestion of food. They were relieved by belching or vomiting. It was also in this group that nocturnal heartburn was a very prominent symptom.

It is of interest that 6 of the patients had co-existing lesions. Two had typical cardiospasm with a moderate sized hiatal hernia. A Heller operation and repair of the hernia were done at the same time. One patient had a large peri-

TABLE 1

Esophageal hiatal hernia

Type of symptoms	
Cardiac	5
Gallbladder	4
Hemorrhage (hemoglobin 50% or less)	7
Peptic ulcer (typical)	36
Esophageal obstruction	8
Total	60

cardial cyst which was removed and the large hernia repaired. Another had a very large diverticulum of the lower esophagus. His hernia contained at least half of his stomach. Both were corrected at the same time. Two patients were found to have gallstones on abdominal palpation. These were not removed.

HERNIA THROUGH THE FORAMEN OF MORGAGNI

This type of diaphragmatic hernia may contain omentum, bowel, or, rarely, the stomach. There may be a vague type of substernal discomfort or symptoms of bowel obstruction. These hernias may occur on either side of the parasternal region and can be seen when the patient is rotated in the oblique or lateral position for the chest roentgenograms. The treatment of this type of hernia is surgical repair provided the patient is a reasonably good surgical risk.

TRAUMATIC DIAPHRAGMATIC HERNIA

Rupture of the diaphragm should be suspected in any severe chest injury, or any crushing injury in this vicinity. It also should be thought of in fractures of the lower dorsal and upper lumbar vertebrae particularly when the fracture is due to the jack-knifing of the patient. This type of hernia may occur in any portion of the diaphragm. The symptoms of hernia may be overshadowed, at first, due to the other associated injuries. The symptoms are due to the displaced organs and their resulting incarceration. Frequently adhesions will form between the herniated viscera and the adjacent chest so that the hernia is not reducible. These hernias all should be repaired as soon as the patient's condition permits as there is a great likelihood of intestinal obstruction occurring.

CONGENITAL HERNIA OF THE NEWBORN

This hernia usually occurs at the foramen of Bockdalek or may be due to congenital absence of the posterior leaf of the diaphragm. It may also occur at the esophageal hiatus or the foramen of Morgagni. These latter are much less frequent. The symptoms of hernia usually are severe and may be respiratory, circulatory, or gastrointestinal; or a combination of all three may be present. This type of hernia should be suspected in any new-born infant with dyspnea, cyanosis, or vomiting during crying or nursing. These infants have a rapid respiration and pulse and the heart will be found to be shifted to the opposite side. Examination of the involved side of the chest may reveal dullness or possibly gurgling from intestinal peristalsis. It is essential that these infants not be given water or any feedings until after the hernia has been repaired. If they are allowed to eat, the intestinal tract will become distended with gas and fluid with the resulting further embarrassment on the heart and respiratory systems. The treatment of the hernia is immediate surgical repair by the abdominal route. Great difficulty may be encountered in closing the abdominal wall due to the underdeveloped peritoneal cavity. If this difficulty is encountered, one should be satisfied to get an adequate closure of the skin and return the patient to the operating room in a few days for a secondary closure after the peritoneal cavity has become adjusted to the abdominal viscera.

TABLE 2

Patients operated upon from 1950 to March 1954

		Deaths
Hiatal	60	1
Sliding	48	
Paraesophageal	12	
Congenital	9	2
Foramen of Morgagni	4	
Traumatic	9	
Postoperative	1	
Total	83	3

DISCUSSION AND SUMMARY

During the period from 1950 to 1954, we have operated upon 83 patients with diaphragmatic hernia (table 2). Sixty of these were of the hiatal type, 9 of the congenital, 4 of the foramen of Morgagni, and 9 were of traumatic origin. One postoperative hernia of the diaphragm resulted following a spleenectomy using a thoracoabdominal approach. It is of interest to note that 6 of these patients had associated disease. Four of these diseases were corrected when the hernias were repaired. Two patients had cardiospasm, 1 a large pericardial cyst, and 1 a large diverticular hernia of the lower one-third of the esophagus; the remaining 2 patients had gallstones. Of the group of 60 hiatal hernias, there was one death. This was due to a fulminating pericarditis that apparently was unrelated to the original operation. The results of the operations were uniformly good.

Two new-born infants with congenital hernias died. They were practically moribund at the time of operation. Complete cures resulted in all of the other patients.

CONCLUSIONS

Symptoms of diaphragmatic hernia commonly simulate those of gallbladder disease, stomach disease, and angina pectoris.

It is our belief that patients with symptoms of these diseases, but in whom the disease has not been proved, should be carefully examined for diaphragmatic hernia.

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SURGICAL TREATMENT OF PRIMARY VARICOSE VEINS*

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The surgical treatment of primary varicose veins is based upon the concept that varicose veins is a progressive degenerative disease affecting primarily, and more or less generally, the walls and valves of the poorly supported superficial veins of the lower extremities. The etiology is based predominantly upon hereditary tendencies and aggravating factors such as pregnancy, and those occupations and diseases which cause an increase in hydrostatic pressure. The resulting venostasis, with its sequellae of dermatitis, ulcer and phlebitis, is due to dilatation of the superficial veins and incompetency of communicating veins with resultant sluggish flow and increased hydrostatic pressure in the superficial veins. Treatment is directed towards interrupting the main paths of communication between the deep and the superficial venous systems and reducing the size of the peripheral bed by removal of superficial veins which are diseased or likely to become so. On account of the frequent anatomic variations and the friability of the veins due to the disease process, the treatment most effective is surgical,[3] consisting of ligation and excision of the veins under visual and palpable control.

Other methods of treatment in common use warrant some discussion. The mechanical vein stripper has considerable popularity and a number of ingenious types[6] have been devised. Its use had the advantages of saving time and requiring few skin incisions; however, the vein removal often is inadequate, as at best it effects a removal of the subfascial trunks in the thigh and leg, the tributaries being severed only as they branch off. It is relatively ineffectual in the case of some anatomic variations and where the veins are friable. It is not applicable to subcutaneous tributaries, which in some cases are of greater importance than the subfascial trunks. The attendant trauma and incomplete hemostasis are not conducive to the best healing.

The injection of sclerosing solutions in conjunction with high ligation of the internal saphenous vein probably is the most commonly used method of treatment. While it is generally productive of early good results and in some cases proves adequate, it is followed by a high incidence of persistence and recurrence of the varicosities, and at times by some thrombosis of the deep veins of the leg and thigh. With injection therapy the extent of thrombosis cannot be controlled and there may follow a fulminating thrombophlebitis of alarming degree with accompanying arteriospasm, resulting in damage to or even loss of the limb. The obliteration of communicating veins cannot be safely and consistently effected. Veins at one time satisfactorily occluded may become recanalized. Of particular importance, the injected fluid commonly finds its way into the deeper veins, as demonstrated by the distribution of radiopaque dye used in making

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venograms, and at times may produce thrombosis resulting in permanent damage. Injection therapy, if used at all, should be limited to the obliteration of residual small unsightly varicosities. In a paper[2] by the senior author published in 1945 on the treatment of varicose veins by high ligation of the internal saphenous vein and the injection of a sclerosing solution at the time and subsequently, there were noted the more serious complications attendant upon this form of therapy. Shortly thereafter treatment by injection of the veins was gradually discontinued, and treatment by excision at open operation was extended.

The examination of a patient for varicose veins should be made with the patient standing on a platform or chair and preferably toward the end of a day of normal activity, as at that time the presence of varicose veins is best detected by vein dilation and dependent edema. The condition of the veins is ascertained by inspection, palpation, and percussion, the last being used to detect pulsation transmitted along tense dilated trunks. In some obese patients pigmentation in the ankle region may indicate the presence of varicosities when they cannot be detected otherwise on physical examination. Venograms may be of value in such cases. The condition of the arterial circulation should be noted. Tourniquet tests are of limited value as they indicate mainly the sites and degrees of retrograde flow only for the brief period after the patient changes from a lying to a standing position, and the patency of the deeper veins in connection with brief exercises. They fail to give evidence concerning the dilatation that occurs on long standing. Valuable evidence concerning the adequacy of the deep venous return may be obtained when a firm supportive bandage,[4] extending from the metatarsal region to the knee, is worn for a week or longer; this also gives a good indication of what can be expected from the definitive treatment of the varicose veins.

In the presence of edema, dermatitis and ulcer, operation should be preceded by a period of treatment with a firm supportive boot[4] extending from the metatarsal region to the knee. This should be continued until the edema has subsided; the dermatitis has healed; and the ulcer has healed or reached a state of chronicity with minimal exudation and devoid of acute inflammatory changes. In the more severe cases this may require several months; however, during this period the patient is ambulatory and engaged in his normal activities.

The indications for and the extent of operation may present something of a problem. There is no prophylactic treatment as such owing to the progressive degenerative nature of the disease with more or less generalized involvement of the extremity. No treatment is indicated for varicose veins of mild degree as the rate of progression cannot be predicted and an operation to be of prophylactic value would be more extensive than warranted by the condition presented. Operation limited to the excision of individual varicosities has limited application as the effects generally are temporary and the results commonly are disappointing. In the average case of well developed varicose veins the operation should consist of high ligation of the internal saphenous vein and excision of the subfascial trunks and the larger tributaries and plexuses of both internal and external saphenous systems, as well as excision of any prominent varicosities of other than saphenous origin.

In the more pronounced cases, and particularly in cases of persistency and recurrence following the above procedure, incompetent perforating veins generally are the important factors in the venostasis. While some of these are obliterated in the excision of the main saphenous trunks and primary tributaries, there remain those connecting the deep veins with the secondary saphenous tributaries and those connecting the superficial veins with the muscular veins. Incompetent perforating veins occur most commonly in the leg but also may occur in the thigh. Their anatomic pattern and treatment have been well described by Sherman.[5] They must be exposed by direct dissection and ligated at or preferably beneath the fascial plane so as to include any accessory perforators. As the dissection must be carried along the fascial plane for a considerable area, one or more vertical incisions are necessary. Access to incompetent perforating veins in the thigh may be difficult due to the tortuosity and friability of the veins leading to them. A chronic ulcer or excessive fibrous tissue under the skin may require excision with grafting of the site. In a few cases the disease is so progressive and extensive that it is difficult to prevent venostasis even with radical and repeated operations.

While pregnancy presents no particular contraindication to operation, it is not the time of choice. During pregnancy it is better to be on the conservative side as regards the extent of the operation. When pregnancy proves to be a particularly aggravating factor, sterilization occasionally is justifiable. Vulval and vaginal varicosities may be of such size and so thinly covered as to require operation during pregnancy. Hemostasis is attended by considerable difficulty as these varicosities empty into the internal iliac systems through trunks which are not accessible because of their depth; however, the results are generally satisfactory.

The purpose of the operation is to provide an adequate venous return and prevent the crippling effects of venostasis. While disfigurement due to operative scars should be kept to a minimum, this is of secondary importance and should be so considered at operation.

On the day before the operation, with the patient standing, the skin over the varicosities is marked with a light scratch which becomes erythematous and easily recognized at operation. Spinal anesthesia generally is preferable, general anesthesia is satisfactory, but local infiltration anesthesia is inadequate. The internal saphenous vein is severed and ligated at the bulb after dividing its uppermost tributaries. Excision of the subfascial trunks, the larger tributaries, and plexuses proceeds from above downward. Horizontal incisions generally are adequate and result in scars less prominent than those in the vertical plane; however, vertical incisions are generally preferable for the ligation of incompetent perforating veins and the excision of excessive fibrous tissue between the skin and the eveloping fascia. The vein excision is made under visual and palpable control.

Excision of the external saphenous system requires that the patient be in a prone position. This is obtained by rolling him from the operating table onto a draped stretcher. It is well to isolate the subfascial trunk first below the knee so as to avoid unnecessary dissection in the popliteal space. The external

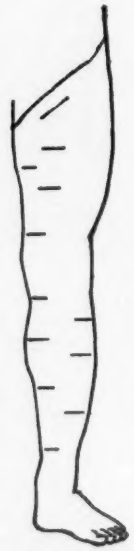

FIG. 1

FIG. 1A

FIG. 2

FIG. 1. Incisions commonly used in case of extensive primary varicose veins

FIG. 1A. Modification used in presence of incompetent perforating veins. Not shown in the illustration, the vertical incision commonly extends posteriorly to and below the medical malleolus.

FIG. 2. Incisions used for the resection of the posterior primary varicose veins

saphenous system is so subject to anatomic variations[1] that it often is better to begin the excision at the level of the ankle. In secondary operations the excision of the dilated trunks and ligation of the incompetent communicating veins are carried out in the manner best suited to the particular case. For the application of the dressing, the patient is placed in the supine position by rolling him onto a second stretcher. He is ambulatory on the day following operation and is discharged from the hospital usually on the second or third postoperative day. The incisions heal nicely and wound complications are rare.

In this procedure, the number of skin incisions and the extensive dissection in the presence of a circulatory disease necessitate particular precautions against wound complications and complications due to venous thrombosis. Incision should be made only through intact and relatively healthy skin. In the presence of persistent dermatitis or ulcer the operation should be staged. After operation the patient should be kept active and ambulatory. This is best accomplished by operating upon only one leg at a time, and in case of extensive disease, doing the operation in stages. Adequate splinting of the soft tissues of the leg and thigh is most important for satisfactory wound healing. This is obtained by the application of a dressing of gauze over which is applied firmly an elastic adhesive bandage from the base of the toes to a level just below the groin. This is not disturbed until the removal of the sutures on about the twelfth day. After this, the leg is supported from the toes to the knee with a boot consisting of a loosely applied layer of gauze impregnated with Unna's paste, and overlying elastic adhesive bandage. This form of support is continued until the skin is in good condition and there is no tendency to swelling. The groin incision is dressed separately to permit earlier removal of the sutures, as motion of the thigh results in painful irritation of the suture line. Antibiotics are administered for the first few days after operation.

DISCUSSION

The treatment of varicose veins by open operation is practically devoid of the type of complications which are associated with treatment by the injection of sclerosing solutions. It effects a more complete removal of the diseased superficial veins than is obtained with mechanical strippers. It interrupts more effectively the communications between the deep and superficial systems than either of the foregoing methods. The procedure is more time consuming and technically more difficult, but this is well compensated for by the low incidence of persistence and recurrence of varicosities, and complications. Due to the progressive nature of the disease, recurrence always is possible, but when it occurs it usually is of limited degree and amenable to treatment by the same method. The patients should be examined at intervals by the surgeon who performed the operation, as little dependence can be placed upon a written communication from the patient or from a physician who is not particularly interested in the subject.

SUMMARY

The surgical treatment of varicose veins is based upon the concept that it is a progressive degenerative disease.

Treatment by open operation most effectively removes the diseased superficial veins and interrupts the main paths of communication between the deep and superficial systems.

Due to the nature of the disease, recurrence is always possible, but is amenable to treatment by the same method.

The use of sclerosing solutions is accompanied by complications due to uncontrolled thrombosis, which may involve the deep veins.

Vein removal by mechanical strippers generally is inadequate.

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DECOMPRESSION OF THE GASSERIAN GANGLION AND POSTERIOR ROOT IN TREATING TRIGEMINAL NEURALGIA*

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In May of 1952, Taarnhoj[6] of Copenhagen described a new procedure for treating trigeminal neuralgia. He had found a small epidermoid tumor of the cerebello-pontine angle in a 31 year old man with typical trigeminal neuralgia. He removed the tumor at craniotomy but did not section the trigeminal root. The patient was completely relieved of his pain and remained symptom free. Taarnhoj then considered the possibility of anatomic compression of the fifth nerve root in its course under the petrosphenoid ligament and through the dura into the ganglia proper. He next attempted to cure a patient with trigeminal neuralgia simply by opening the dural sheath over the ganglion and posterior root and by cutting the petrosphenoid ligament. He accomplished this procedure through the intradural route. The same procedure has been followed since that time by Love[4] and others at the Mayo Clinic, by the extradural route with equally good and immediate results.

This operation is the most important advance in the treatment of trigeminal neuralgia that has occurred since Victor Horsley[7] did his retro-gasserian neurotomy in 1891. Horsley avulsed the trigeminal nerve through the temporal approach and the patient died seven hours later of shock.

The search for surgical relief of trigeminal neuralgia was not abandoned, however, and in 1901, Spiller and Frazier of Philadelphia demonstrated that if the trigeminal root were cut posterior to the ganglion there would be no regeneration of the trigeminal nerve fibers, and that a permanent cure could be obtained.

Since 1925, when Frazier[3] described his operation of differential section of the gasserian ganglion, severing only the lower two branches and saving the motor root and ophthalmic division, there have been few refinements in the surgical care of this difficult disease.

The complications encountered in patients who have had fifth nerve section, either partially or totally, have led to continued efforts to improve on Frazier's method. In 1938, Sjoqvist[5] of Sweden severed the descending tract of the fifth nerve in the medulla and obtained relief from trigeminal neuralgia. The advantage of this procedure was that it eliminated the sequelae of anesthesia and paresthesia, or the burning and crawling sensation encountered in patients with fifth nerve section. This procedure, however, is of a considerably greater magnitude than that of the retro-gasserian neurotomy done in the temporal fossa. Dandy[2] claimed certain advantages for section of the fifth nerve by the posterior fossa route. He stated that nearly 10 per cent of patients with trigeminal neu-

* Presented during The Oklahoma City Assembly of The Southwestern Surgical Congress, Oklahoma City, Oklahoma, Sept. 20–22, 1954.

ralgia had tumors of the cerebello-pontine angle with pressure on the fifth nerve, and he claimed a much smaller percentage of neuroparalytic keratitis and paresthesia than usually is found after sectioning all or portions of the fifth nerve by the temporal route.

As far as the medical treatment of true trigeminal neuralgia is concerned, there is not much to be said. Trichlorethylene was used by Plessner,[7] and this has, in certain instances, given relief. This was discovered in German aircraft factories during the First World War, when it was found that some individuals who had been working with trichlorethylene developed unilateral paralyses of the trigeminal nerve. It was tried in an effort to give relief of trigeminal pain, and in a certain small percentage did give temporary relief.

Nearly every other drug in the pharmacopeia has been tried for relief of trigeminal neuralgia. The latest of these is vitamin B-12, given by mouth or, preferably, in massive injections intramuscularly. A considerable degree of success has been claimed for this drug. Practically every patient upon whom I have operated has had multiple massive injections of vitamin B-12. Usually these injections have given temporary relief. I believe that vitamin B-12 will eventually go the way of typhoid vaccines, smallpox vaccines, and all the other medical treatments that have been used thus far for the treatment of this disease. As Dandy once stated in commenting on the medical treatment of Meniere's disease, trigeminal neuralgia is a disease that lends itself beautifully to statistical analysis. In other words, whatever the patient has been doing or taking just before his attacks disappear, to this agent he attributes his relief. Trigeminal neuralgia is a disease which comes and goes. Therefore, regardless of what agent is used, if it is continued long enough, the neuralgia will spontaneously disappear for a time at least. And whether it is vitamin B-12 or sterile water, it seems to me that the result will be about the same.

There are certain other measures which have been advocated and used in the past for patients with trigeminal neuralgia. Alcohol injection has been preferred in some clinics as an initial treatment to accustom the patient to the numbness and paresthesias that he may experience after nerve section. In my opinion, alcohol injection is a difficult procedure, causing considerable discomfort to the patient and should be limited to those patients for whom no surgical therapy is advised, namely, those people who are so debilitated and so far advanced in age that any surgical procedure is prohibited. Furthermore, there are certain difficulties with alcohol injection that make its use prohibitive. In a person who has genuine trigeminal neuralgia, it is almost certain that that person will submit to operation sooner or later. If a good result is obtained with alcohol injection, there is almost certain to be alcohol in the gasserian ganglion. The fibers of the gasserian ganglion are matted together and scarred by this procedure, making it very difficult for the surgeon to do an accurate differential section or a decompression of the posterior root and the petrosphenoid ligament. Furthermore, alcohol injection rarely, if ever, cures the disease.

Avulsion of the peripheral portions of the nerve at the supraorbital, infraorbital, or the mental foramen has been practiced. Its most important use is in

patients whose trigeminal pain originates in the ophthalmic division. Avulsion of a peripheral branch is purely a temporary measure as the pain usually recurs within six months or less.

SYMPTOMS AND SIGNS

Trigeminal neuralgia is initiated by sudden, severe, lancinating pains occurring in one or more divisions of the fifth nerve. This pain rarely, if ever, crosses the midline. When a patient has an attack of trigeminal neuralgia, he usually stops whatever he is doing and holds the side of his face and waits until the pain stops before he continues. There frequently is a trigger area at the vermilion border of the upper lip, and when this trigger point is touched by either the hand or by food, the pain is set off. Some patients thus have great difficulty in eating. Some cannot wash their faces and may appear with one division of the facial area unwashed, and, if they are men, frequently unshaved. The pain usually disappears as suddenly as it appears. There is no hypesthesia or anesthesia. The attacks are more common in the daytime than at night; rarely do they keep the patient awake. Between attacks, when the patient demonstrates his pain to the examiner, usually he points with one finger to the course of the pain. One should doubt the diagnosis of trigeminal neuralgia when the patient demonstrates the course of his pain by laying his whole hand on the side of his face to demonstrate the location of his pain. These attacks may come on at any time of the year, but they seem to be more common during the spring and fall, and during times of changing weather than at other periods.

ETIOLOGY

The etiology of this disease is still unknown, although it occurs most commonly in the sixth, seventh, and eighth decade of life. It is rare in persons under the age of 30. Women have the disease slightly more frequently than men, and it is slightly more common in the right side than in the left. The mandibular division more often is involved; the maxillary division less often, and the ophthalmic division the least often.

DIFFERENTIAL DIAGNOSIS

The diagnosis and differential diagnosis of trigeminal neuralgia are made by exclusion and by history only. There are no abnormal physical findings. The Costen[1] syndrome always must be considered and a roentgenogram should be made of the mandibular joint. Usually a diagnosis of this syndrome can be made by an inspection of the mouth. A patient who has been long without the posterior molars, either of the upper or lower jaw, should have his bite mechanism corrected. As far as I am concerned, the patient who comes in complaining of sudden, severe, lancinating pain and has had it over a period of years and has had considerable manipulation of the temporomandibular joint mechanism by his dentist—this patient has trigeminal neuralgia and does not have a temporomandibular joint syndrome. It is my opinion that the two definitely can be differentiated in most instances, and there is little point in subjecting the pa-

tient who is suffering from definite severe trigeminal neuralgia to manipulations of the temporomandibular joint mechanism.

Sinus disease may cause attacks typical of trigeminal neuralgia. Every patient suspected of having trigeminal neuralgia should have roentgenograms of his sinuses to rule out acute and chronic sinusitis, carcinoma, or other disease involving the mucosa of the sinuses.

Tumors invading the floor of the skull from the nasopharynx may cause typical trigeminal-like pain, but this pain usually is constant and is accompanied by paralysis of the nerve and anesthesia of the corresponding area. Tumors of the cerebello-pontine angle usually have other accompanying neurologic signs, such as deafness, and dizziness. Migraine usually is characterized by visual symptomatology and usually is prolonged, although it is limited to one side. Histaminic cephalalgia occurs commonly at night; involves the whole side of the face and is characterized by unilateral lacrimation and nasal discharge on the side of the pain. It is very difficult to confuse this disease with typical trigeminal neuralgia. This particular type of pain can be brought on by subcutaneous injections of histamine and relieved by injections of adrenalin.

OPERATIVE PROCEDURE

The operative procedure is approached by the extradural route, in the same manner as the old posterior root section. A decompression incision is made anterior to the ear and just above the malar arch (fig. 1). The temporal muscle is incised and separated. A perforator opening is made into the temporal bone and enlarged to a little larger than 2.5 cm. in diameter. The dura is separated in the floor of the temporal fossa. The middle meningeal artery is coagulated and cut at the foramen spinosum. The mandibular division is identified and injected with novocaine containing a minute quantity of adrenalin. The dura is separated further up over the gasserian ganglion to expose the dural covering of the posterior root where it is reflected from the dura proper. This point occurs at the petrosphenoid ligament. This procedure usually involves considerably more bleeding than did the old procedure simply of cutting the posterior root. When the posterior root is completely exposed, often there is considerable bleeding from the superior petrosal sinus and at the upper edge of the posterior root from the cavernous sinus. I have found this bleeding fairly easy to control by the use of gelfoam. When all bleeding has been controlled an incision is made in the dura over the ganglion proper from the middle root back into the posterior root. Then using a small dural scissors, the petrosphenoid ligament is caught with the scissors and cut (fig. 2). The posterior root is completely decompressed and one can look directly into the posterior fossa at the emergence of the fifth nerve from the anterior border of the pons. This gives the added advantage of being able to determine whether there is any tumor present in the posterior fossa, such as a pontine angle tumor originating in the eighth nerve. There is a further advantage in this method of procedure. The fourth or trochlear nerve varies in different individuals in its course from the midbrain into the lateral wall of the cavernous sinus, or medial dural wall of the gasserian ganglion. When

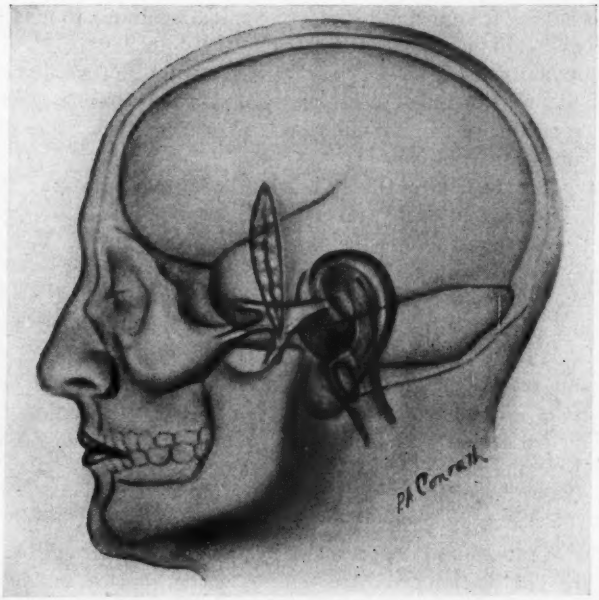

FIG. 1. Diagram showing incision and relative location of the gasserian ganglion and posterior root in the temporal fossa.

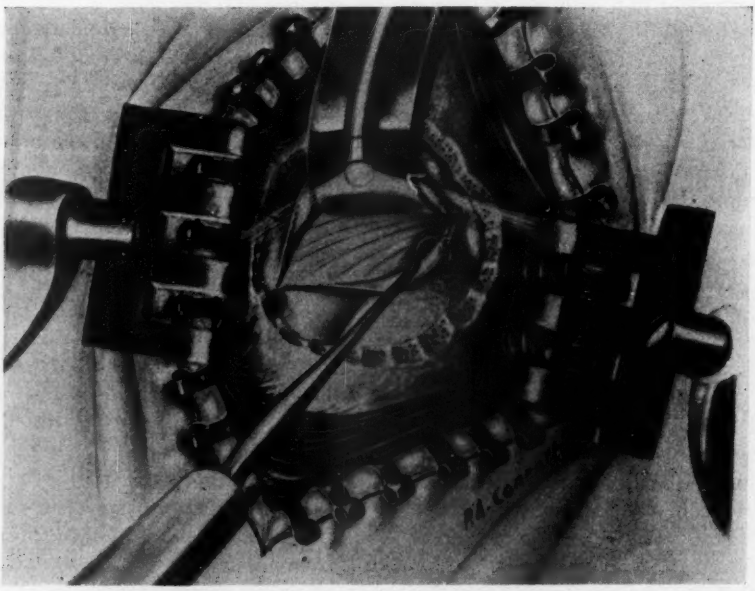

FIG. 2. Operation completed—decompression of gasserian ganglion and posterior root. Nerve hook demonstrates location of petrosphenoid ligament.

the incision is started in the dura over the gasserian ganglion and carried up to the petrosphenoid ligament, there is very little chance of cutting the trochlear nerve, whereas with the procedure as described by Taarnhoj, where the petrosphenoid ligament is cut from above down, it would seem probable that the trochlear nerve might be more easily injured. After the nerve root is completely decompressed, a small piece of gelfoam is placed over the decompressed area and the dura at the temporal lobe is allowed to fall back in place. The wound then is closed in routine fashion.

RESULTS

The operative procedure described above has been done on 27 patients who were thought at the time of operation to have severe trigeminal neuralgia. Subsequent results are as follows:

Twenty-four patients have had complete and lasting relief for from one month to two years. One patient has had a fair result, but has had some return of her trigeminal pain, although it has not been as severe as that suffered before the operation was done. This patient has not yet decided to have her posterior root cut. In 1 other patient, I was unable to separate the dura from the gasserian ganglion proper, and it was necessary to cut the entire posterior root. The third patient had had a cerebral vascular accident on the side where her neuralgia presented. This patient, likewise, had many other complaints, such as dizziness and headache, besides her shooting neuralgic pain. Decompression of her gasserian ganglion and posterior root gave relief from her sharp shooting pain, but because she had no relief from her headaches and from her other difficulties, she accounted the operation a failure. Since that time she has had a course of electric shock treatment and her family physician reports that she is much better. She, likewise, has normal sensation of the side of her face that was involved. This particular patient brings up the subject of atypical trigeminal neuralgia. It is my belief that there is no such thing. Either a patient has trigeminal neuralgia, which is a definite and typical syndrome, or they do not have trigeminal neuralgia. It is my opinion that this particular patient did not have trigeminal neuralgia. Such patients do poorly no matter what surgical procedure is used on the fifth nerve. In my experience, the patients who did poorly with nerve root sections for their supposed trigeminal neuralgia were those in whom the diagnosis was in doubt.

There is one danger in this procedure as I see it at the present time. Because of the fact that these patients can now be operated upon and leave little or no neurologic deficit, it may be more of an invitation to operation than was the old operation of nerve root section with its possibility of paresthesia and with its definite anesthesia in the area involved. This procedure should not be used on people who have atypical trigeminal neuralgia and should be reserved for those people only who have definite trigeminal neuralgia.

I have had 2 patients who had differential sections done previously, with good results for a period of two years and three years respectively, and then had a return of their pain in the ophthalmic division. I have been able to section their petrosphenoid ligament and dura over the posterior root with subsequent relief

of their trigeminal pain while maintaining the continuity of the ophthalmic division.

DISCUSSION AND SUMMARY

At the present time it is still too early to evaluate this procedure finally. There is a good deal of discussion in neurosurgical circles at the present time as to whether the relief that has been obtained in these patients will be permanent or not. It seems to me that this discussion is entirely academic and that the procedure should be done on those patients who have trigeminal neuralgia. We are, now, with this procedure, at the same stage that Spiller and Frazier must have been about two years after their first section of the posterior root for trigeminal neuralgia. There must have been some doubt in their minds as to whether the cure of trigeminal neuralgia by posterior root section would be permanent. The only way that one can tell whether the relief will be permanent is to do the procedure and then await results. Obviously, only time will tell, but in fairness to the patient, he should be given the benefit of this procedure which will give him no neurologic deficit, no loss of sensation in the face and no paresthesias, in preference to the nerve severing operation until such time as the nerve severing operation becomes necessary.

In this series of 27 patients, there have been 3 patients who have had temporary sixth nerve paralyses to a minor degree. In my experience, the sixth nerve paralysis can be obviated if one works toward the lateral side of the gasserian ganglion and the posterior root while doing the dissection. It is only when the dissection is extended well over the medial side of the gasserian ganglion and the posterior root that one gets into the complication of sixth nerve paralysis. The possibility of section of the trochlear nerve in doing this dissection has been mentioned above.

Temporary facial nerve paralysis which has been encountered in the past in the section of the trigeminal nerve occurs about as frequently in this decompression procedure as in the old nerve-cutting procedure, and so far as I know no reason has been given to account for this.

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A METHOD OF DIAGNOSIS OF CHOLEDOCHAL CYST*

REPORT OF A CASE

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Owing in part to the uncommon occurrence of congenital cystic dilatation of the common bile duct, there is a dearth of information regarding the means of making the diagnosis. Since Vater first described the entity of common bile duct cyst in 1723 (cited by Lavenson[5]), only 195 cases have been reported in the literature. Consequently, the choledochus cyst often is omitted in a differential diagnosis of abdominal conditions that should suggest its presence. This is unfortunate, for experience has shown that the mortality rate is much higher in those patients in whom the preoperative diagnosis is not made, and is indeed higher when the diagnosis is not even suspected. It is the purpose of this paper to stimulate a higher index of suspicion of choledochus cysts and to outline methods that may be employed to arrive at an accurate diagnosis. Shallow and associates[7, 8] cite that, in the first 175 reported cases, the preoperative diagnosis was suspected in only 12.6 per cent and was made in only 8.6 per cent. In those cases in which the correct diagnosis was made or suspected, the operative mortality rate was 36 per cent; in those cases in which the correct diagnosis was neither made nor suspected, the mortality rate was 62 per cent. In the differential diagnosis of abdominal conditions it is, therefore, important to consider the choledochus cyst and employ the pertinent studies that establish a precise diagnosis *before* exploratory laparotomy.

CLINICAL FEATURES

Cysts of the common bile duct have been reported in patients ranging from several months to 64 years of age,[6] but the majority of the cases have occurred in children under 10 years. One case was reported in a stillborn infant.[2] The condition occurs more commonly in males at a ratio of 3:1. Tumor, jaundice, and pain constitute a typical triad of symptoms,[1] but these three findings are observed inconsistently in any given patient.[3] A palpable tumor usually is present at sometime during the course of the disease and characteristically shows a variable size which is related to eating. The mass enlarges after meals. Nausea and vomiting may accompany acute exacerbations of the disease, but fever and signs of local peritoneal irritation are present only when there is an associated inflammation of the cyst or gallbladder. When any combination of these symptoms is recognized, certain roentgenologic studies should be made.

ROENTGENOGRAPHIC FEATURES

A survey film of the abdomen demonstrates the presence of a soft tissue mass (fig. 1). The right renal outline usually is clearly visible through the homogeneous

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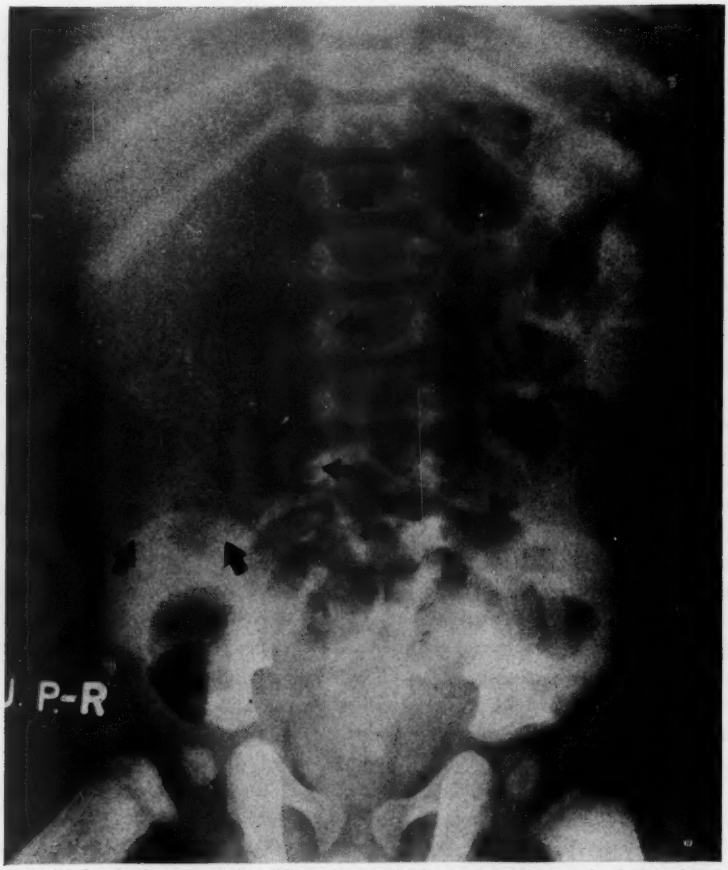

FIG. 1. Abdominal survey film. There is a soft tissue mass (arrows) of unit-density on the right side blending with the liver shadow and extending to the iliac crest. The bowel and stomach are displaced away from the mass. The normal right renal outline is clearly visible through the homogeneous mass.

density of the cyst and thus enlargement of the kidney is excluded as the source of the mass. The bowel is displaced from the right upper quadrant. These findings are only presumptive evidence of a choledochus cyst and an upper gastrointestinal roentgenologic study is necessary to demonstrate the characteristic displacement of the individual segments of the gastrointestinal tract (fig. 3). The stomach is displaced downward and laterally. The duodenum is dislocated medially, inferiorly, and anteriorly. The remainder of the small bowel is displaced in a similar fashion and the hepatic flexure of the colon is depressed. Cholecystography shows nonvisualization because the gallbladder is small and nonfunctioning. This roentgenographic finding is not specific, but implicates disease in the biliary tract. It was not until 1947 that Kjellberg[4] reported the

aspiration of a cyst, followed by the injection of a radiopaque medium. Some writers have not endorsed this procedure because of the theoretical hazard of bile leakage resulting in bile peritonitis. However, Kjellberg reported no ill effects in his patient. In the patient in the case reported here, aspiration was done twice without complication. As far as we are able to determine, these are the only 2 patients in whom this procedure has been used. If a needle with a small gauge is used, the danger of leakage is minimal. Moreover, the case presented here shows that the cyst contained only low concentrations of bile because of the dilution produced by the serous fluid secreted from the cyst wall. Therefore, spillage of the cyst contents would be of less consequence than the spillage of gallbladder bile. If aspiration is done, the fluid withdrawn should be subjected to laboratory analysis. While the aspirating needle still is in place, a small quantity of water-miscible contrast medium and air may be injected to replace the fluid withdrawn. Roentgenographs made with the patient in various positions will be of significant value (fig. 4). The contrast medium will occupy dependent positions within the cyst and clearly define its smooth, round cystic nature and delineate its anatomic position in the subhepatic space. Films of the abdomen taken several minutes subsequent to the injection of the contrast medium may show the presence of a normal excretory urogram (fig. 5), an important diagnostic sign that will be interpreted and discussed below.

The following case illustrates the diagnostic features of a patient with a choledochus cyst. Some of the roentgenograms have been used by one of the authors (J. W. W.) in another paper to illustrate one type of abdominal cysts,[9] but this represents the first report of the case.

CASE REPORT

U. W., a 10 month old Negro male, first was admitted to Parkland Hospital on May 15, 1953, with the history of abdominal swelling of eight or nine hours duration. According to the infant's parents, the present illness began approximately one week prior to admission when the child developed diarrhea and had five or six green, watery stools in a 24 hour period. No blood was noted in the stools at any given time. The patient had shown anorexia but otherwise did not appear ill. He vomited on two occasions. Four days prior to admission, he developed fever and his temperature rose to 102 F. By the next morning his temperature had fallen to normal, but rose to 101 F. in the afternoon. A similar temperature elevation occurred each subsequent afternoon until the day of admission. Late in the afternoon on the day before admission, the parents noticed the child's abdomen was swollen. They stated that his abdomen always had shown some distention after meals but this was the first time that it had been noted to persist. The abdomen continued to enlarge slowly and the patient became irritable. He was unable to sleep; therefore, he was brought to the emergency room at approximately 12:30 a.m. on the day of admission.

Past history. The infant had been delivered at term and exhibited normal development. His only illness had been a respiratory infection at the age of 5 months from which he had recovered rapidly and completely.

Physical examination. The temperature was 99 F, and the respirations were 36 per minute. The general appearance was that of a well developed, well nourished, Negro infant who was in no acute distress. Examination of the eyes, ears, nose, throat, heart and lungs revealed no abnormality. The abdomen was bulging in the flanks and quite protuberant. There was evidence of abdominal tenderness, particularly on the right, for the child resisted vigorously any attempt to examine the abdomen. No discrete masses could be out-

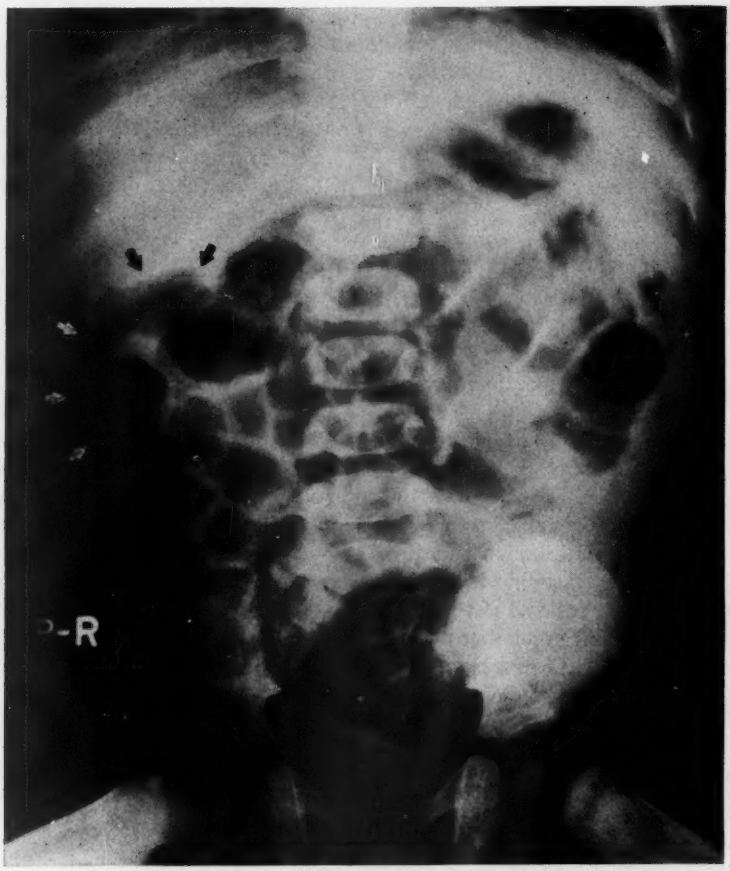

FIG. 2. Abdominal survey film following aspiration of mass. No mass is discernible and the gastrointestinal segments have been restored to their normal locations. Note the position of the stomach, duodenal cap (black arrows), the duodenal sweep (white arrows) and compare their positions with those in figure 3 after re-expansion of the cyst.

lined, but there was a definite sensation of tenseness in both the right upper and right lower quadrants. On percussion there was a tympanitic note anteriorly with dullness in the right abdomen; the dullness persisted in the right flank when the left side was dependent. Hyperactive bowel sounds were heard. No masses were palpable by rectal examination. After rectal examination the patient passed a small yellow, semiformed stool. No blood was noted.

Roentgenologic and laboratory studies. The hemoglobin was 8.2 Gm. per 100 ml., and the white blood cells were 29,500 per cu. mm. with a differential count of 50 polymorphonuclear leukocytes (10 bands and 40 segmented forms), 41 lymphocytes, and 9 monocytes. The urinalysis was normal. A scout film of the abdomen upon admission disclosed a soft tissue mass occupying the entire right upper quadrant with displacement of the bowel to the left (fig. 1). The mass had the roentgenologic characteristics of a cyst. A number 21 gauge needle was inserted carefully in the right upper quadrant, and 500 ml. of green, bile-stained fluid was

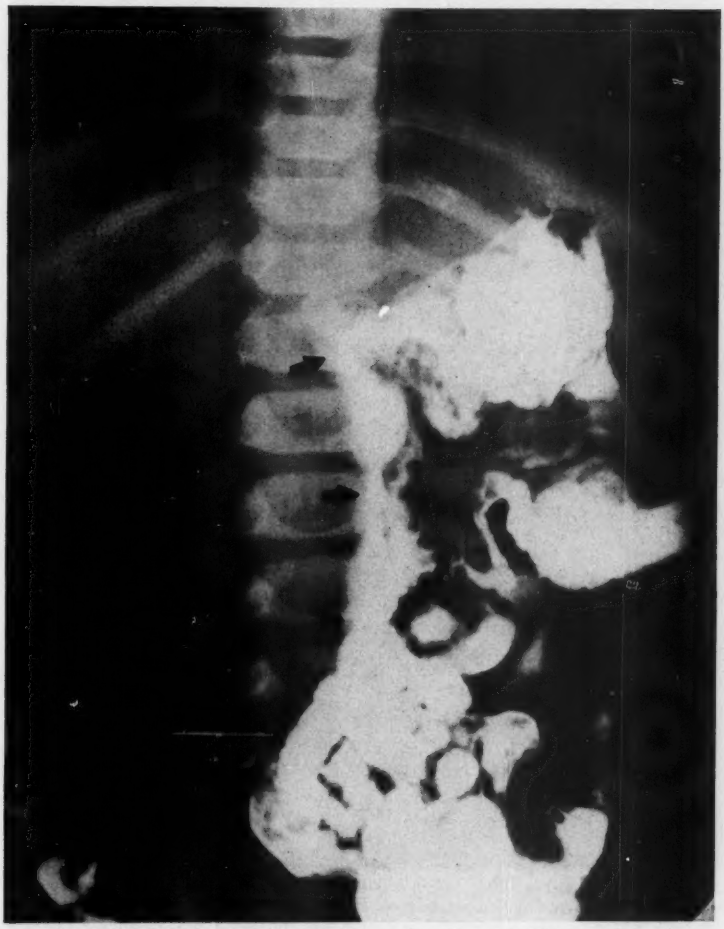

FIG. 3. Gastrointestinal series done 24 hours after figure 2. The cyst has re-expanded to occupy almost the entire right side of the abdomen and the displacement is evident. Note particularly the angulation of the gastric antrum and dislocation of the duodenal bulb and retroperitoneal portion of the duodenum (arrows) across the midline and downward. No obstruction is demonstrable although the cyst produces an extrinsic impression on the duodenum.

aspirated. A roentgenogram taken after the aspiration showed no trace of the mass previously demonstrated (fig. 2). By laboratory analysis, the fluid was found to give a weakly positive direct Van den Bergh reaction, and it contained 1.4 Gm. per cent protein and 3.6 mg. per cent bilirubin. No organisms were obtained from a culture. There was a negative direct blood Van den Bergh, and the blood urea and blood urea nitrogen were 28 and 13 mg. per 100 ml., respectively. The blood chloride was 100.5 mEq/L., and the CO_2 combining power was 18.9 mEq/L.

After removal of the fluid, the child's abdomen was scaphoid. Palpation of the abdomen no longer was resisted, and the patient slept comfortably through the examination.

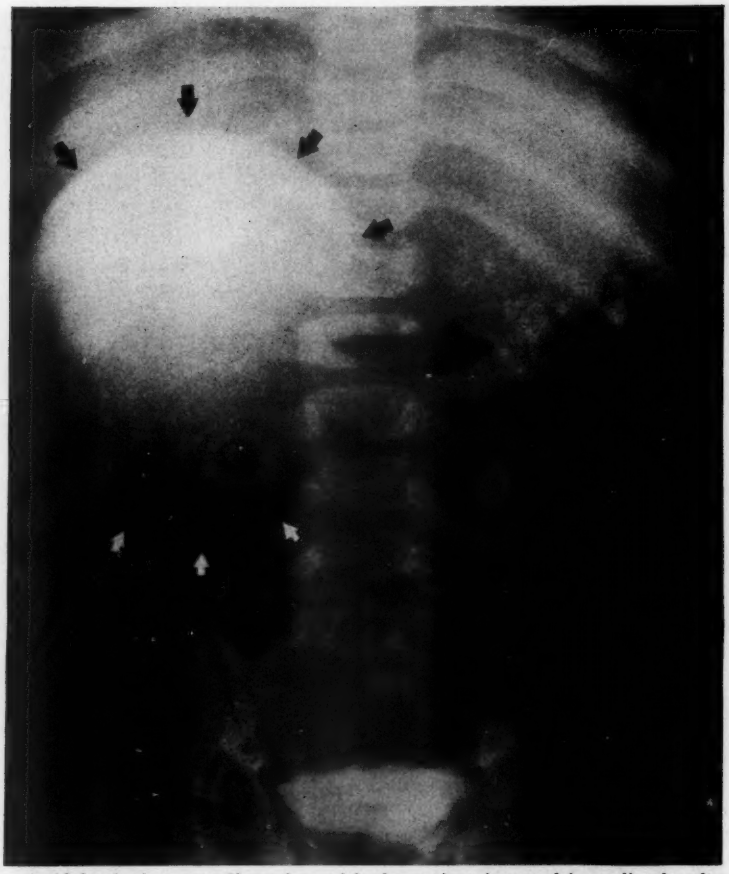

FIG. 4. Abdominal survey film taken with the patient inverted immediately after injection of air (white arrows) and opaque contrast substance (black arrows) into the cyst. The contrast media occupy dependent portions and outline a well delineated cyst below the liver shadow. Some urinary excretion of the opaque medium has already occurred (note opacification of the urinary bladder).

Approximately eight hours later the abdomen was reexamined; it was distended but not to the proportions that were observed on admission. An upper gastrointestinal roentgenologic study was made (fig. 3). The segments of the gastrointestinal tract were displaced by an extrinsic mass, but no encroachment upon the lumen of the stomach or duodenum was demonstrable. The transit of the barium solution was normal. It was noted that the retroperitoneal portion of the duodenum was displaced obliquely downward and to the left and anterior to its normal location.

Further roentgenologic studies were recommended. A needle was inserted into the cyst and a fluid, similar to that removed at the first aspiration, was withdrawn. Through the same needle, approximately 10 ml of 35 per cent Diodrast® and 10 ml. of air were injected. Roentgenograms were taken with the patient in various positions (fig. 4). These films clearly showed that the mass was a well circumscribed cyst interposed between the duo-

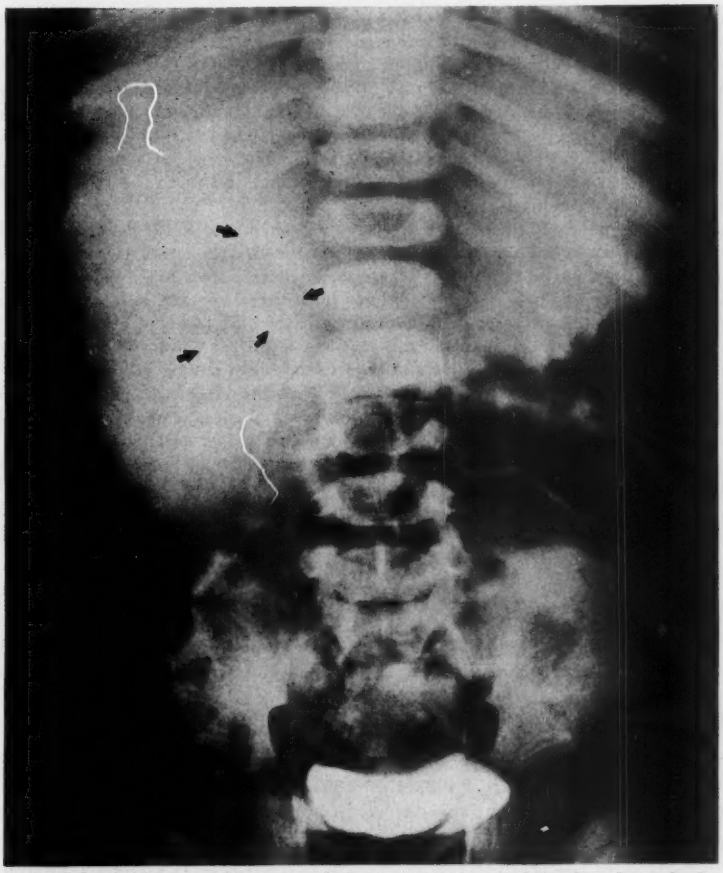

FIG. 5. Abdominal survey film exposed 15 minutes after the injection shown in figure 4. The cyst is homogeneously opacified. There is a normal urogram clearly visible on the left and through the cyst shadow on the right (arrows). Portions of both ureters are visualized and the urinary bladder is more densely opacified.

denum and liver. Its contour and size were delineated. On an exposure taken 15 minutes after the introduction of contrast media into the cyst, a normal excretory urogram was obtained (fig. 5). The interpretation was that the opaque substance had passed from the cyst into the intestinal tract where it was absorbed and then excreted by the kidneys. With these findings, the diagnosis of choledochal cyst was established and preparations were made for operation. The patient was given multiple small blood transfusions until the hemoglobin level was 12.5 Gm. per 100 ml.

Operative findings. On May 19, 1953, an operation was done under general anesthesia. The abdomen was entered through a right rectus incision. When the peritoneal cavity was opened, a large cyst was found in the right upper quadrant which extended into the right lower quadrant; it measured approximately 8 cm. in diameter. The mass displaced the duodenum anteriorly and to the left; the colon was displaced toward the left and downward. The cyst appeared to be retroperitoneal. When the overlying peritoneum was incised,

the cyst was easily freed laterally, inferiorly, and medially. When an attempt was made to free the cyst superiorly, difficulty was encountered, and no further dissection was done. The hepatic and cystic ducts were dilated and entered the cyst at the point of their confluence. An anastomosis between the cyst wall and duodenum was considered the procedure of choice. To facilitate mobilization of the cyst, the fluid had been removed by a trochar and the opening left in the cyst wall was enlarged slightly and used to anastomose the cyst to the second portion of the duodenum. When the anastomosis was completed, the abdomen was closed without drainage and the patient was taken to the recovery room in good postoperative condition.

Postoperative course. The patient developed fever which rose to 103 F. Penicillin, 200,000 units were given every six hours, but the fever continued. The chest was clear to examination until the third postoperative day when coarse rhonchi were heard in both lungs posteriorly. A roentgenogram of the chest did not show any abnormality. Large quantities of mucus were aspirated with an intratracheal catheter and frequent coughing produced copious bronchial secretions. Wangensteen suction was maintained for two days postoperatively until peristalsis became active and the patient began having soft brown stools. The fever began to abate and he was discharged from the hospital in good condition on the fourteenth postoperative day. An upper gastrointestinal roentgenologic study was made six months postoperatively. The study showed a normal upper gastrointestinal tract with no displacement of the duodenum. There was no reflux of the barium or intestinal gas into the biliary tract and there was no suggestion of a persistent dilatation of the common bile duct. When last seen, 15 months since the operative procedure, he had gained weight and developed normally. There was no evidence of infection of the biliary tract.

COMMENT

The combined clinical, laboratory, and roentgenologic findings in the case outlined above made possible a precise diagnosis of choledochus cyst. A summary of these salient features and an explanation of how they collectively permit a differential diagnosis is warranted.

In the diagnosis of any abnormal process, the clinical manifestations offer the first indication of the underlying disease. In this malformation, there is characteristically a mass which shows a perceptible enlargement after meals. However, a similar history may be obtained in infants with any cyst that communicates with the intestinal lumen. Nevertheless, periodic distention of a mass (associated with eating) in the right upper quadrant should suggest a choledochus cyst and lead to appropriate roentgenologic investigation.

Aside from the barium study disclosures already described, emphasis is placed upon the important finding of displacement of the retroperitoneal portion of the duodenum. This segment is firmly anchored and remains fixed when other portions of the stomach or intestine may be displaced by masses in the peritoneal cavity. Therefore, when this feature is observed, all other forms of intraperitoneal cysts may be excluded. Although the choledochus cyst displaces the intestine, it produces no obstruction, and the emptying time of the stomach and the transit of barium through the intestine are not delayed.

Aspiration of the cyst, as recommended in this paper, provides three channels of investigation: (1) the determination of gastrointestinal communication by introducing contrast substances through the aspirating needle; (2) laboratory analysis of the fluid; and (3) the delineation of the exact position of the cyst and its anatomic relationships. An excretory urogram following injection of the

opaque medium into the cyst is conclusive evidence that continuity between the cyst lumen and the gastrointestinal tract exists, for it is necessary that the medium enter the intestinal tract before it is absorbed and excreted by the kidneys. It is not feasible that absorption by the cyst wall could be sufficient to produce an excretory urogram, particularly within a 15 minute interval following the injection. The implications of this finding are obvious since all types of cysts which have no gastrointestinal communication may be eliminated from the differential diagnosis.

The relatively high concentration of bilirubin in the cyst fluid indicates that the cyst must communicate with either the liver, biliary tract, or gastrointestinal tract. It is noted, however, that the bilirubin concentration is less than that of pure bile which is apparently the result of secretion of a serous fluid from the cyst wall. The finding of dilute bile excludes the possible consideration of having aspirated a normal or distended gallbladder. The presence of a direct Van den Bergh reaction tends to exclude hemorrhage into a cyst as the source of the biliary pigment.

Descriptions of the roentgenographic features of the cyst outlined by the direct injection of contrast material are listed in the preceding paragraphs and if properly interpreted are characteristic of the common bile duct cyst.

It is possible to differentiate other abdominal cysts which may simulate a choledochus cyst by application of the diagnostic methods just described.

Omphalomesenteric duct cyst. Cystic dilatation of a persistent omphalomesenteric duct may, like a choledochus cyst, show a perceptible enlargement after meals. However, these two malformations may be readily dissociated by the roentgenologic studies. Their anatomic positions and relationships are different and the displacements of adjacent structures are entirely dissimilar.

Enterogenous cysts. Duplication of the duodenum may in many ways mimic the choledochus cyst; however, the former infrequently maintains any communication with the lumen of the intestinal tract. Consequently, no enlargement after meals should be noted and the contents of the cyst do not contain bile. Similarly, the presence of an excretory urogram following injection of an opaque medium into the cyst would tend to exclude the enteric cyst since this finding depends upon a patent intestinal communication. Since enteric cysts are predisposed to vascular embarrassment, infarction, and hemorrhage, biliary pigment derived from hemoglobin may be present in the fluid, but will not give a direct Van den Bergh reaction. Cysts of the common bile duct do not encroach upon the intestinal lumen; therefore, the flow of barium in the intestinal tract is not impeded. Conversely, the enterogenous cyst, by virtue of its intimate continuity with the wall of the intestine, produces partial or complete mechanical obstruction to the adjacent intestinal segment; and the signs of obstruction will register both clinically and roentgenographically.

Pancreatic cysts. Like choledochus cysts, pancreatic cysts are known to occur at any age. The roentgenographic features of the two cyst types differ widely. Although pancreatic cysts may lie in close proximity to the duodenum, they are incapable of displacing the descending (retroperitoneal) limb of the duodenum

anteriorly or to the left. No patent communication exists between the pancreatic cyst and the intestine. If aspiration of the cyst yields bile and injection of the cyst with Diodrast® results in an excretory urogram, pancreatic cysts may be excluded. An analysis of the aspirated fluid of true cysts or pseudocysts of the pancreas may disclose pancreatic enzymes.

Mesenteric and omental cysts. There should be little difficulty in differentiating mesenteric or omental cysts from choledochus cysts. The manifestations of these cysts differ. Mesenteric and omental cysts are clinically silent; the roentgenographic features do not resemble those ascribed to choledochal cysts. The former have no continuity with the lumen of the gastrointestinal tract and may show chyle, rather than bile, upon laboratory examination of the fluid.

Hydronephrosis. A hydronephrotic kidney should be considered first as the cause of any retroperitoneal cyst, but it is easily excluded by normal urographic findings. Renal cysts may be differentiated by the same means.

SUMMARY

The importance of a preoperative diagnosis in choledochus cysts is demonstrated by the lower mortality rate of those cases in which the diagnosis was made or suspected. The clinical signs and symptoms and characteristic roentgenographic features are described. A method of confirming the diagnosis by aspiration of the cyst with injection of contrast medium is discussed. A case is presented in which this technic was used to establish the diagnosis, and the points that permit a differential diagnosis are elaborated.

Acknowledgement. We are indebted to Ben J. Wilson, M.D., Chairman and Professor, Department of Surgery, Southwestern Medical School of the University of Texas, for his advice and assistance in the preparation of this paper.

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APPENDICITIS WITH PERFORATION AND SUBPHRENIC ABSCESS*

REPORT OF A CASE WITH UNUSUAL COMPLICATIONS

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Serious complications rarely attend simple acute appendicitis. Appendiceal perforation, however, constitutes an entirely different problem. The most dreaded and lethal late sequel to perforation of the appendix is subphrenic abscess and its complications.

Although excellent publications concerning subphrenic abscess are to be found in the literature, it seems worthwhile to review briefly some of its features.

Subphrenic abscess may arise from many sources but usually is secondary to an intra-abdominal suppurative process. Ochsner and DeBakey found that approximately one-third of the cases are accounted for by infections of the appendix.[8] The incidence in all cases of acute appendicitis is said to be approximately 0.9 per cent and this increases sharply when only appendicitis with perforation is considered. It should be remembered that of all the patients with signs and symptoms indicative of subphrenic infections, only a small minority develop abscesses.[8]

It generally is believed that the incidence of subphrenic abscess has materially decreased since the introduction of antibiotics.[12] Certainly its morbidity and mortality rates have been reduced. Thus Berens and associates[1] observed that the duration of postoperative fever and hospitalization were reduced by more than 50 per cent. Similarly, the death rate was only 40 per cent of that observed before antibiotics.

The most common mode of spread of infection from the appendiceal area to the subphrenic space is along the right paracolic gutter, this being aided by the aspirating effect of the fluctuating negative pressure beneath the diaphragm.[9] There also is a rich lymphatic drainage to the subphrenic space from the abdominal cavity[4, 6, 11] as well as retrograde lymphatic communication with the chest.[10] Subphrenic infection may sometimes be secondary to pylephlebitis or suppurative hepatitis.

The diagnosis of subphrenic abscess often is too long delayed. A high index of suspicion is the key to diagnosis. Pain and fever are the most common symptoms. Physical signs include tenderness, percussion dullness and decreased breath sounds over the lower adjacent chest due to pleural fluid, atelectasis or pneumonitis. Suggestive roentgenographic findings are elevated diaphragm, pleural effusion, pulmonary parenchymal changes and subphrenic gas collection.[1] Needle aspiration of the subphrenic space as a diagnostic aid is mentioned only to be condemned. When aspiration fails, as often is the case, it tends only to delay definitive therapy.[2]

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Subphrenic abscess is attended by a high incidence of satellite complications. Thoracic complications were responsible for the presenting symptoms in 45 per cent of a large series of cases recorded by Hochberg.[5] Pleuritis with effusion, empyema, pneumonia, lung abscess, bronchopleural fistula, diaphragmatic perforation, mediastinitis and pericarditis may occur. The gravity of these complications is demonstrated by Ochsner and DeBakey's series of 75 personal cases in which the mortality rate was 50 per cent in those with thoracic complications as compared to 16.3 per cent when the infection remained below the diaphragm.

Surgical drainage is the only rational definitive therapy for subphrenic abscess. There is a reported series treated without operation with a 90 per cent mortality rate.[8] Transerous drainage has a mortality rate variously reported between two and five times that of the extraserous route.[8, 12] Therefore, the surgical approach to the subphrenic space should, whenever possible, be extraserous. The posterior extrapleural approach, first advocated and described by Nather[7] in 1922, is the choice for posterior abscesses. The extraperitoneal route described by Clairmount and Meyer[3] is best for anterior abscesses.

We recently have treated a patient in whom complications of acute perforative appendicitis have resulted in prolonged morbidity. The interesting development and course of the illness in this patient prompt this report.

CASE REPORT

A 62 year old white man—carpenter—entered a hospital in June of 1952 because of a three day history of abdominal pain typical of appendicitis. One day prior to his hospitalization he had fallen across a ladder striking his abdomen, which accentuated the pain.

Operation was delayed until the day following his admission to the hospital (four days) at which time a perforated appendix was removed. A drain was placed in the right abdominal gutter. On the fifth postoperative day he had a wound dehiscence with evisceration. A perforated terminal ileum and generalized peritonitis were discovered and a segment of bowel was resected. Culture of the abdominal fluid showed staphylococcus aureus sensitive to several of the antibiotics. Three days later a roentgenogram of the chest showed pleural effusion at the right base. Penicillin, streptomycin and aureomycin were begun. Despite this treatment, the patient developed a wound infection with multiple draining sinuses, and an incisional hernia resulted. There was gradual but incomplete clearing of the chest findings shown in the roentgenogram.

Hernia repair in December 1952 was followed by a recurrent wound infection. The patient then was asymptomatic until June 1953, when he had a sudden paroxysm of severe cough which produced a recurrence of the incisional hernia.

The patient entered another hospital for a second hernial repair, but the operation was deferred when a routine chest roentgenogram showed an opacity in the right lower lung field. The cough had become productive of large quantities of purulent sputum, and a low grade fever was noted. Streptomycin, penicillin and terramycin were given and the cough subsided. Bronchoscopic examination disclosed what was thought to be a tumor at the orifice of the right lower lobe bronchus. Bleeding was so profuse from this area that a biopsy section could not be done. However, tissue removed by swabbing was reported to be suspicious of neoplasm. The patient accordingly was transferred to McKinney Veterans Hospital in August 1953 with the diagnosis of bronchogenic carcinoma.

He was afebrile. There was restricted motion of the right chest with dullness on percussion and absence of breath sounds from the midscapular region to the base of the lung. There was no costovertebral angle tenderness. The abdomen was soft. There was a large incisional hernia to the right of the lower midline.

Roentgenograms showed a density which was interpreted as pleural effusion in the lower half of the right chest. Planigrams outlined a cavity approximately 2.5 cm. in diameter communicating with a bronchus in the posterior basilar segment. Complete diagnostic study, including bronchoscopy and scalene biopsy, failed to corroborate the suspicion of neoplasm.

Thoracentesis yielded 300 cc. of purulent material, the cultures of which showed a heavy growth of nonhemolytic staphylococcus aureus which was sensitive to erythromycin, but resistant to aureomycin, terramycin, penicillin and streptomycin.

At thoracotomy a localized empyema was entered and during exploration of this cavity a thick-walled sinus tract was found leading from an abscess cavity in the basilar portion of the lung through the diaphragm communicating with a large subphrenic abscess. The segment of lung containing the abscess was resected; decortication was done and the opening in the diaphram was sutured. The posterior suprahepatic space was drained through the flank below the diaphragm. The chest was closed in layers after placing two water-seal drains in the pleural space. A culture of the material removed, grew a nonhemolytic staphylococcus aureus sensitive only to bacitracin.

After the operation antibiotics were withheld. There was a mild temperature elevation from 99 to 100 degress due to a wound infection.

Six weeks after thoracotomy the patient began to have vague abdominal complaints with large amounts of flatus and pain in the right upper quadrant. There was tenderness over the right lower chest posteriorly and a roentgenogram showed a haziness in this area. Thoracentesis yielded 200 cc. of purulent material. This recurrent empyema was drained by rib resection.

In December 1953 radiopaque material was injected to determine the extent of the infected space. Branching sinus tracts extended in several directions, including a communication with the area of wound infection. Accordingly the old wound was reopened; the chest wall sinuses were excised or curetted, and several sections of ribs were removed. One of the sinuses communicated with a small bronchus in the area of the resected lung abscess. No attempt was made to close the bronchus. The patient's general condition improved considerably during the next few weeks although there was a persistent small bronchial fistula. The latter was excised and successfully closed in February 1954. A deep granulating tract in the soft tissues has now (June 1954) filled in with granulation tissue and the patient is at home and doing well.

DISCUSSION

In retrospect it is an easy matter to reconstruct the course of events and to point out errors and omissions in the management of the case presented.

This patient might have been spared a two year illness had he been operated upon early for acute appendicitis. The source of the perforation of the terminal ileum is unknown. It may have been overlooked at the time of appendectomy or may have resulted from an error in technic at this operation.

The roentgenographic demonstration of pleural fluid associated with signs of peritonitis eight days after appendectomy should have suggested the presence of a subphrenic infection. It is almost certain that thoracentesis, additional roentgenograms and fluoroscopy would have made the diagnosis and confirmed the indication for surgical drainage.

Almost every known antibiotic was used at one time or another. It should be emphasized that the results from antibiotics, although at times life saving, are not all good. Subphrenic cellulitis often will respond favorably to antibiotic therapy. They are, however, of little aid if there is abscess formation. Furthermore, an abscess may be present for a long time (14 months in this patient) and

symptoms may be masked by antibiotics. These problems have multiplied as antibiotics have been extensively used. If fever, pain and other symptoms of infection are not controlled within a few days, it should be assumed that an abscess has developed. The antibiotics then should be discontinued and the full blown picture allowed to develop so that it may be adequately dealt with by surgical drainage.

The organism responsible for this patient's infection was, or became, resistant to every antibiotic except bacitracin which was never used.

It is believed that the failure of the original drainage to cure this patient's subphrenic abscess and thoracic complications can be attributed to the persistent bronchopleural fistula. Ultimate cure was accomplished only by the final adequate surgical drainage, confirming a principle which has been well founded almost since medicine began and yet, one which we tend to forget in this modern era of the *magic mold*.

SUMMARY

A patient is presented who developed acute appendicitis which was unattended until after perforation of the appendix. Generalized peritonitis ensued and a subphrenic abscess developed. Thoracic complications in the form of pleural effusion, pneumonitis, atelectasis, diaphragmatic perforation, lung abscess, bronchopleural fistula and empyema resulted. A subphrenic abscess was present and was unrecognized for 14 months. Eventual cure required many operative procedures, and prolonged hospitalization. Morbidity was extensive. The course of this patient's illness and some of the errors in management are discussed.

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EDITORIALS

THE ANESTHETIC FROM THE SURGEON'S POINT OF VIEW

Most anesthetists believe in keeping the patient *as light* during an operation as is consistent with the operative procedure which is being done. Certainly the surgeon should support the anesthetist in this point of view. However, it goes without saying that the surgeon does not want the patient *so lightly* anesthetized that he struggles and interferes with the operation. In following out this well conceived principle of no more anesthesia than is absolutely necessary, a great many anesthetists believe that the patient should be almost awake when the operation is finished. With the patient *very light*, they will often put a catheter into the trachea to suck out the mucus. Under such a minimum degree of anesthesia this procedure almost invariably starts the patient to coughing and struggling.

What effect does this have on the abdominal wound, and especially on a hernia wound, that has just been closed? I once had the following experience while operating upon a large ventral hernia in a big muscular man: With the patient *very light*, the anesthetist, who was giving cyclopropane, started to change the cannister, and while she was doing it, the patient started straining and broke heavy silk mattress sutures which had been placed in the abdominal fascia. These sutures broke *right under vision and with a loud report*. All of us have seen similar struggling at the end of an operation after the wound has been closed, especially when the anethetist, with the patient *light*, sucks out the trachea. Undoubtedly sutures are sometimes broken then, but the fact is not evident because the wound has been closed and the broken sutures cannot be seen. I have thought for years that many hernias recur while the patient is still in the operating room due to such straining and the consequent breaking of sutures. It is also quite likely that many postoperative ventral hernias have their beginnings in the same way.

How are such occurrences to be prevented? In the first place, there must be the utmost cooperation between the efforts of the anesthetist and those of the surgeon. Both are working to the same end—the optimum result for the patient—and if their respective aims are thoroughly discussed, and each understands exactly what the other is driving at, there should be no difficulty in arriving at a plan of procedure satisfactory to both. Then the patient can be kept *light* enough for safety and *deep* enough to prevent straining under the anesthetic.

Of course the importance of keeping the patient from coughing and straining is less in some types of operations than it is in others. For instance, at the end of open chest procedures, little harm is done if the patient coughs. Also in this type of patient it is particularly desirable that the tracheo-bronchial tree be left perfectly clean. With the skillful administration of the anesthetic, it is entirely possible to have the patient *light* at the end of the procedure, and ready to awaken in a short time without coughing and straining. The use of Anectine, the new

very short acting curare-like drug, is a great help in preventing such difficulties when the patient is *lighter* than the anesthetist expected him to be.

In the case of abdominal operations—and especially hernia operations—it is very important to eliminate struggling and straining. Naturally when the patient starts to recover from the anesthetic after operation, he is going to turn and twist and do some straining. As soon as this starts, if he is given a relatively large dose of morphia or other narcotic, straining can be eliminated. Then the patient will *sleep the anesthetic off* and not *struggle it off*. When the effect of the narcotic wears off, the effect of the anesthetic will long before have disappeared and pain will keep the patient from straining or struggling sufficiently to break sutures or to harm his incision in any way.

At the conclusion of abdominal or hernia operations, the degree of anesthesia of the patients should be discussed by the surgeon and the anesthetist. If a patient is so light that he may start struggling on the way back to his room, he should be given a narcotic before leaving the operating room. If he does have enough anesthesia to carry him safely back to his room without struggling, floor nurses should be instructed to administer a narcotic as soon as he shows any evidence of abnormal movements. Such precautions often save a suture line.

The importance of properly handling the procedure of clearing the trachea of mucus at the end of an operation is clearly shown by the following case: An orthopedist, in one hospital in which I work, had just finished a spinal fusion and had applied the cast. The anesthetist started sucking out the trachea, the patient began struggling, and the orthopedist could hear the screws in the bone graft tear loose, which necessitated opening the wound and repairing the damage. Closer cooperation between the surgeon and the anesthetist, as indicated above, might have obviated this regrettable accident.

In some hospitals it is the practice, after the patient returns to his room, for the nurses to try to get him to *react*. This is done by their gently slapping the patient's face, asking him his name and address, or engaging in any other sort of *tomfoolery* that comes into their heads. It is done to save nursing time. As soon as the patient *reacts*, they feel free to leave him and go about their other chores. This may be in the interest of the nurses, but what about the interest of the patient? Some hospitals lose sight of the fact that *hospitals are for patients*, and not for the hired help, such as nurses, doctors and orderlies. I strongly believe that a patient's recovery from an anesthetic should be as smooth and uneventful as possible. This will not be the case if he is to be annoyed by slaps and subjected to asinine questioning. Those of us who have had general anesthetics know well enough that as soon as the first tinge of pain is felt on becoming semi-conscious, we immediately want a narcotic—and not in homeopathic doses either—but in doses large enough to really kill the pain. When such doses are given, the patient usually sleeps for hours and awakens refreshed and with a minimum of pain. After that, as a rule, very little narcosis is necessary, and it should be kept at a minimum in order to prevent pulmonary complications.

A word about recovery rooms. These are also labor saving devices. If run properly, they may exhibit the best form of postoperative therapy. Such recovery

rooms are staffed with competent nurses skilled in taking care of patients fresh from the operating room. Unfortunately, all recovery rooms are not so run. In one of our leading hospitals the recovery room consists of a small room across from the operating rooms into which patients are *wheeled* on a wheel litter and left there on their backs with a nurse in attendance until they *react*. They are kept from falling off the litter by a relatively narrow leather strap which goes around the litter and around the patient's *middle*. There is no opportunity for properly turning the patient. I recently saw one of my own patients given morphia in this so-called recovery room at about the time he *reacted*. After he was sound asleep from the morphia, he was taken downstairs and transferred to his bed. Not satisfied with not waking the patient up by this procedure, the orderly then attached metallic sides to the bed with a clatter that sounded like a *Sherman tank* running over a field of scrap iron.

We believe that it goes without saying that such a recovery room is run for the benefit of the nurses and not for the patients. The uppermost thought in the minds of everyone around a hospital should be that *hospitals are for patients*. When I finished operating recently in the hospital just referred to, I suggested that the patient should be put into his bed from the operating table, and not on the wheel litter from which he had to be transferred to his bed later. A nurse spoke up and said "The beds are too heavy to push around," and yet before the so-called recovery room was instituted, the beds in this hospital were always taken to the operating room and the patient put immediately from the operating table into his bed. The fact is that the *so-called* recovery room is too small to accommodate enough beds for the postoperative patients but is large enough to accommodate enough wheel litters. What are we coming to, when some of our best doctors countenance an arrangement that is for the benefit of the hospital but to the detriment of the patient?

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SPECIFIC AND PROPHYLACTIC ANTIBIOTIC THERAPY

The development and exploitation of chemotherapy and antibiotic therapy in the treatment of infectious processes has introduced new concepts regarding the specific attack on the bacteria in these infections. Even though modes of action of these drugs are not clearly understood, and may differ one from the other, their sum effect is an antagonistic one on the development of bacteria and in some instances might exert a direct bactericidal action on the micro-organisms. This concept of the antimicrobial action of the therapeutic agent has changed; the pathogenesis of infections remaining as it was prior to their introduction. It is conceivable that this specific antibacterial therapy has altered the pathogenesis of many infections in that the infection is aborted prior to the development of its full pathology. However, in that all therapy of infection has in the past been directed toward eradication of that infection at the earliest possible stage, the introduction of these newer drugs should be interpreted only as a new and more specific attack by which this can be effected in the greater number of cases. Therefore, in the truest sense the pathogenesis of any infection has not been altered, only the development of the full pathologic condition may have been aborted.

Antibiotic or chemotherapy to be effective has to be specific against the bacteria of the infection in the individual case in which it is being employed. The term specific has been loosely used to denote its action against species of different micro-organisms, which can be misleading in that these drugs are strain specific within the species. The variation in the sensitivities between strains of a species of bacteria can include the entire range from being very sensitive to those with increasing resistance often exceeding the concentrations of the antibiotic which could be achieved by any method of administration. Nevertheless, it is fortunate that in the development of the various antibiotics, the antibacterial spectrum has been so studied as to designate the species and not necessarily the strain against which an antibiotic is most likely to be effective. This fact should be interpreted to mean that in any infection with the known species of bacteria that the majority of the strains of that particular species are likely to be sensitive to the action of that particular antibiotic. However, variation in the strain specificity of the species often will account for failure in those infections which do not respond to an antibiotic in the expected period of clinical trial.

Meleney, Pulaski, Longacre, and others have emphasized that there is a rational approach in the selection of a drug in specific antibacterial therapy. As has been pointed out, regardless of the antibacterial spectrum of an antibiotic, this spectrum is referred to only in the sense that strains within the designated species will be sensitive. For an antibiotic to be effective it is necessary that it be effective against the strain causing the infection. This strain specificity is assuming new importance in that strains of previously sensitive species seem to be either increasing in resistance or there is a decrease in the numbers of sensitive strains within a sensitive species. As previously mentioned, rational antibacterial

therapy is dependent upon two main points: the first, and probably of most significance, is clinical knowledge of infectious processes, including identity of the most likely etiologic organism causing the various infections; the second most important point is a bacteriologic analysis of the infection with determination of the antibiotic sensitivities of the strains recovered.

Contrary to popular belief, the advent of antibacterial therapy has increased the necessity for a more thorough grounding in the studies of the bacteriology of the various infections. It is upon this basic knowledge that the selection of the initial antibacterial therapy against an infection will depend. With this information delay and errors of choice, pending bacteriologic analysis and sensitivity studies, can rationally be avoided. The selection of an antibiotic with a broad antibacterial spectrum without any etiologic possibility is not to be condoned.

The importance of the bacteriologic analysis with indicated sensitivity tests in those infections which are resistant to the initial antibiotic selected is self-evident. Unfortunately, however, many laboratories are not equipped to make these analyses, whereas all too frequently laboratory facilities are not available. Regardless of these physical deficiencies, it is important that a rational approach requiring analysis and sensitivity studies guide in the continued therapy in these refractory cases. The results of these analyses will permit and direct the selection of the most likely antibiotic to be effective in any case.

The availability of adequate facilities for making these studies is somewhat dependent upon the attitude of medicine in a given community. If the demand for these bacteriologic studies is sufficient, it follows that in most instances facilities for them usually will be found. Therefore, the responsibility for establishing and maintaining such facilities is not entirely that of hospitals, but rests partially on the hospitals and partially on the attending doctors, with adequate support in the benefit to their patients.

The extended use of these antibacterial drugs to newer infections, as well as to increased numbers of patients, has been attended by an increased incidence of reactions of various types. The incidence and type of reactions will vary somewhat depending upon the antibiotic being employed and its route of administration. Reactions to each and all of the antibiotics have been reported, the majority of which most fortunately have been of a minor type. There are sufficient numbers of severe, and in some instances even fatal reactions, being reported to demand a more critical attitude to include the likelihood of a reaction and the consequences of such a reaction in relation to the possible benefits of the antibacterial action either prophylactically or therapeutically.

The prophylactic use of antibiotics in clean surgical cases, such as hernia and thyroid, simple incisions involving the subcutaneous tissues, with excision of simple tumors or hand surgery, or other similar types of surgical procedures should be considered indiscriminate and is mentioned only to be condemned. Under ideal surgical conditions the incidence of infection in this group of patients is insignificantly low, and the benefits to be derived from this type of therapy often are far less than is the likelihood of a more serious complication attributable to the antibiotic. Prophylactic antibiotic therapy cannot and should not be em-

ployed to replace, or in any way minimize the necessity of adhering to the basic principles of aseptic technique with the execution of the surgical procedure based on knowledge of clean wound healing. Close adherence to these principles should make the employment of prophylactic antibiotics more likely to be a hazard than to be a benefit in these types of cases.

The preoperative preparation of the intestinal tract for large bowel surgery constitutes prophylactic therapy in its strictest meaning. Prior to the adjunct of the antibacterial drugs, such as the chemotherapeutic drugs or the antibiotics, this preparation was limited to the mechanical cleansing of the bowel by means of purgation and enema. This accomplished the removal of all particulate matter, but other than decreasing the numbers of bacteria present, probably in no way modified the bacteria flora of the large bowel. Following this preparation the bowel usually would be found collapsed and more suitable for the operative procedure which had been contemplated.

The dread of infection following or coincidental to operations upon the large bowel had been considerably alleviated following close adherence to the proper preparation of the intestinal tract depending entirely upon purges and enemas. The incidence of infection in the peritoneum directly attributable to the minimal contamination after adequate mechanical cleansing probably is not known. The total incidence of infection of the peritoneum in large bowel surgery is a composite of the possible infection resulting from contamination at the time of the operation, plus the infection developing following a leakage at the site of the anastomosis or from some other place in the bowel. The reports in the later years just prior to the introduction of prophylactic antibacterial therapy in preparation of the bowel indicated that the incidence of intraperitoneal infection following mechanical cleansing alone of the bowel prior to surgical procedures had been reduced significantly, in some series assuming a much lesser importance than complications other than infections. Therefore, the value of the specific attack on the bacterial flora of the large intestine prior to the operative procedure on the large intestine may appear at the outset to be exerting an adjunctive beneficial effect on the morbidity in these cases, but as yet this is at the most only circumstantial and not proven.

The advocates of antibacterial preparation of the large bowel prior to surgery of the large intestine emphasize its possible importance in reducing the incidence of intraperitoneal infections and also in the prevention of wound infections. Without entering into a discussion of the significance of the size of the inoculum at the time of the contamination in its relation to the development of a possible infection, suffice it to say that bacteriologically this relationship still adheres to all principles of bacteriology. Experience with massive uncontrolled contamination of the peritoneum as a result of trauma has confirmed that the peritoneum is very resistant to contamination from the large bowel. Therefore, since the actual incidence of peritoneal infection attributable to the contamination at the time of surgery is not known and since, the contamination can be minimized effectively with simple cleansing of the bowel by purgation and enema, and since the peritoneum as an organ is attenuated to cope with very large con-

taminations from this source, the value of oral administration of antibacterial agents in an attempt to sterilize the contents of the large bowel prior to surgery is unconfirmed. The low incidence of infection following large bowel surgery should not be attributed to any single factor, much less solely to the preoperative prophylactic antibacterial therapy of the contents of the large intestine.

The prophylactic administration of antibiotics parenterally in the postoperative phase as a guard against possible infection of the contaminated field following large bowel surgery has much merit. Prior to its use in this manner it had been advocated that the abdominal wound should be closed only up to the subcutaneous tissues. If closure of the subcutaneous tissues and skin were attempted, a drain was advocated in all instances. However, since the advent of antibiotics which are effective against the flora in intestinal tract, closure of these wounds without drainage has been possible with the minimal risk of subsequent infection. At present the antibiotics of choice in the prophylaxis of these infections probably remain a combination of penicillin and streptomycin. Penicillin in doses—as the procaine salt—of 450,000 units combined with streptomycin, one gm. every 12 hours over a period of three to four days postoperatively, has proven to be very effective in minimizing the risk of the wound infection in these cases. The effect of this parenteral postoperative antibiotic therapy on the peritoneal contamination which occurred at the time of surgery cannot even be estimated. It is known that parenteral antibiotics exert a beneficial effect in cases of peritonitis, and it is highly conceivable that this parenteral administration exerts a very strong influence on the decrease in the incidence of the above infection.

Report from the Mayo Clinic and others describe reactions to the drugs used in preoperative preparation of the bowel. The incidence of reactions is very low, but in many instances are severe enough to offer major therapeutic problems of their own. Of these the most distressing is the effect on the intestinal tract itself, either as a direct action of the medication, or as a result of the change in flora of the intestinal tract which is dependent upon the antibacterial action of the medication. This has manifested itself as a pseudomembranous colitis varying in severity from a very mild diarrhea to very severe colitis characterized by the development of ulcers and pseudopolyp formation. Roentgenograms of these intestinal tracts, particularly of the large bowels, show lesions that are comparable to those seen in cases of long standing ulcerative colitis.

Bacterial studies have indicated that one of the etiologic agents in this development of pseudomembranous type of ulcerative colitis following antibacterial therapy probably is a resistant staphylococcus of enterococcus variety. However, that this is the only etiologic agent in this condition is very unlikely. There have been evidences to indicate that upon the decrease of the bacterial flora of the large bowel the resistant molds and yeast, particularly that of the monillia, will overgrow and are in themselves capable of producing a colitis similar in type. Also, a monoliasis of the vaginal tract and of the oral cavity have been reported following oral administration of these antibiotics.

It has been suggested that in conjunction with the wide spectra antibiotics or

the unabsorbable sulfonamide drugs that a specific antibiotic, such as erythromycin, carbomycin, or neomycin be administered in conjunction in order to eliminate the undesirable enterococcus. If antibacterial therapy of this type is employed in preparation of the bowel for operation, the addition of a specific antibiotic against the staphylococcus, which probably is an etiologic agent of the pseudomembranous colitis, should be part of this preparation. It is evident that considerable investigation of this problem is indicated to establish the exact value of this type of prophylactic therapy in large bowel surgery. Clinical reports of the benefits of the use of antibacterial drugs in preoperative preparation of the bowel are substantiated in the decreased morbidity of the cases reported. The statistical significance of these reports is open to criticism and in no way contributes to the conclusions often made.

Antibiotic therapy, since its inception in the last decade, has been concerned with efforts to discover antibiotics in an attempt to extend the antibacterial spectrum of these drugs. Reports of therapeutic benefits derived from the clinical application of these drugs in the treatment of infections have served to establish their position in the therapeutic armamentarium against these infections. More recently reports indicate a possible changing picture both from the development of newer antibiotics, and also in the results of treatment of infections which previously were susceptible to previous antibiotics. Many of the previous species of bacteria are being found to be more resistant to the action of an antibiotic, particularly in the staphylococcic group. This changing picture in antibiotic therapy also includes the increasing reports of undesirable side reactions in increasing numbers. Therefore, with this particularly changing phase of this type of therapy it is high time that revaluation of antibiotic therapy in the treatment of infections be undertaken.

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PERFORATING INFLAMMATION OF THE VERMIFORM APPENDIX[1]

WITH SPECIAL REFERENCE TO ITS EARLY DIAGNOSIS AND TREATMENT

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The American Journal of the Medical Sciences, October, 1886

It appears that even the most recent systematic writers are by no means agreed as to the exact relation of inflammation of the caecum and that of the appendix to peritonitis and perityphlitis. The vital importance of the timely and appropriate treatment of the disease in question is becoming more and more apparent. Such treatment is often postponed till hopeless, even if its application is at any time entertained. It was, therefore, to be anticipated that the critical consideration of a large number of unquestionable cases of perforation of the caecal appendix might serve to make prominent the features essential for diagnosis and treatment.

In 1834, James Copland, in his Dictionary of Practical Medicine,[2] first discriminated between inflammations of the caecum, the vermiform appendix, and the pericaecal tissue. Isolated cases of fatal inflammation of the appendix had been published from time to time before this date. Their importance did not become well recognized, however, till after Dupuytren's views had been made known concerning the relation of the caecum to the production of what hitherto had been termed iliac abscess, or phlegmon of the iliac fossa. At the instigation of this eminent surgeon, Husson and Dance,[3] published an article on the subject, apparently his ideas. These were subsequently personally presented by him in his Lectures on Clinical Surgery.[4]

In consequence of the interest thus aroused, Goldbeck,[5] at the suggestion of Puchelt, of Heidelberg, wrote this graduation-thesis upon the same subject. He adopted the views of the French writers, and applied the term perityphlitis to the disease described. His essay contains the report of a case of perforation of the appendix and associated peritonitis. But he regards it as one of fecal retention, and as quite distinct from the perityphlitis or inflammation of the connective tissue around the caecum. He states that in fatal cases of the latter affection the appendix has been found intact.

Of the various names connected with the early history of the disease under consideration that of John Burne, Physician to the Westminster Hospital, de-

[1] Read before the Association of American Physicians, June 18, 1886.
[2] Vol. i. p. 277.
[3] Répertoire Gén. d'Anat., etc., 1827, iv. 154.
[4] Lecons Orales de Clin. Chir., 1833, iii. 330.
[5] Ueber eigenth. entz. Geschw. i. d. rechten Huftbeingegend, 1830.

serves particular mention. In the first[6] of two admirable articles separated by an interval of two years, he calls attention to the material difference in the character of inflammation of the appendix and that of the caecum. He attributes this difference to the peculiar conformation and situation of the former. His second paper[7] contains an additional number of cases of affections of the caecum and appendix, a criticism of the opinions of the French writers, and a reiteration of his own views with such modifications as a more extended experience permitted. The name typhlo-enteritis is offered as an equivalent for inflammation and perforative ulceration of the caecum and of the appendix.

In the interval between the publication of the above-mentioned articles Albers[8] contributed a paper on inflammation of the caecum. He first introduces the term typhlitis, and discriminates between acute, chronic and stercoral typhlitis and perityphlitis. He charges Puchelt and foreign writers with confounding the last affection with the acute and stercoral varieties of typhlitis. The frequent termination of the perityphlitis in abscess is recognized, likewise the possibility of communication between the pus-cavity and that of the appendix or caecum. This communication he regards as secondary. He says,[9] "It is not at all clear just why the processus vermiformis should be so often affected, for in this disease perforation of the caecum should be far more likely than that of the appendix."

Although the term perityphlitis thus became synonymous with inflammation of the pericaecal tissue, the tendency was inevitably toward the recognition of a somewhat similar clinical picture and a different anatomical seat. Oppolzer[10] discriminated between cases of perityphlitis where the inflammation was situated in the connective tissue about the caecum, and others where the inflammatory swelling lay between the iliac fascia and the bone. These were further distinguished from cases of encysted peritonitis in this region, and from perforation of the appendix. The latter was stated to be always productive of a circumscribed peritonitis, except when the perforation took place through the adherent peritoneum. Then both peritonitis and inflammation of the subperitoneal tissue would occur. The anatomical seat of the inflammatory process was thus further complicated. Oppolzer suggested the term paratyphlitis, which, according to Eichhors,[11] represents an inflammation of the connective tissue behind the caecum, while perityphlitis designates an inflammation of the peritoneal coat of the caecum and appendix. Typhlitis is applied to an inflammation of the appendix and of the caecum. Whittaker[12] uses the same definitions, while Ziegler[13] applies the term typhlitis to inflammation of the vermiform appendix, and perityphlitis to that of the parts in its vicinity.

The clinician obviously recognizes as of the chieftest importance the parts to which local treatment may be directly applied. His attention is thus

[6] Med.-Chir. Trans., 1837, xx. 219.
[7] Ibid., 1839, xxii. 33.
[8] Beob. auf d. Geb. d. Path. und Path. Anat., 2ter Theil., 1838, 1.
[9] Op. cit., p. 19.
[10] Allg. Weiner med. Zeitung, 1858, xx. 81; xxi. 86.
[11] Hand. d. Spec. Path. und Therap. 2ter Aufl., 1885, ii. 188.
[12] Pepper's System of Pract. Med., 1885, ii. 814.
[13] Lehrb. d. Path. Anat., 4te Aufl., 1885, ii. 1.

conspicuously directed to the caecum, which may be evacuated, or to the perityphlitic abscess, which may be emptied. The pathologist looks for the seat and causes of the disease, and finds that in most fatal cases of typhlitis the caecum is intact, while the appendix is ulcerated and perforated. He sees that the so-called perityphlitis abscess is usually an encysted peritonitis. Furthermore, if an abscess exists in the pericaecal fibrous tissue, it is in most instances caused by an inflamed appendix. Finally, if the encysted peritoneal abscess, or the abscess in fibrous tissue behind the caecum, does communicate with the latter, such an opening is usually the result, not the cause, of this abscess.

With,[14] influenced by the predominant importance of the independent consideration of inflammation of the appendix and its results, uses the term appendicular peritonitis to indicate the perityphlitis proceeding from disease of the appendix. As a circumscribed peritonitis is simply one event, although usually the most important, in the history of inflammation of the appendix, it seems preferable to use the term appendicitis to express the primary condition. This may terminate as an appendicular peritonitis or as a paratyphlitis. In like manner the rare, primary, perforating typhlitis (caecal perforation) may be followed by a perityphlitis—that is, an encysted peritonitis about the caecum, or by a paratyphlitis. The perityphlitis abscess of the surgeon, when seen early, is thus usually an encysted peritonitis of appendicular origin. More rarely, at this date, it may be the result of a suppurative paratyphlitis. The causes of this last affection are numerous and by no means confined to the appendix or caecum, although a perforating inflammation of each of these parts of the intestinal tract may act as a cause.

Any attempt at explaining the various results of an inflammation of the appendix, must necessarily be preceded by a statement of the peculiarities it may present, with respect to structure and position. These peculiarities, though in part of congenital origin, in most instances bear evidence of having been acquired as the result of previous disease. This statement, based upon a long personal experience, is more than confirmed by the observations made elsewhere. Matterstock[15] states that Tungel, during a period of two years at the Hamburg Hospital, found 30 instances of partial or complete obliteration of the appendix, 43 cases of catarrh and fecal concretions, 12 of abnormal adhesions, and 11 of tuberculous ulcers. All these in addition to perforations, and despite the fact that attention was not invariably directed to such peculiarities. Toft, as referred to by With,[16] found the appendix diseased in 110 out of 300 post-mortem examinations, every third person thus possessing a diseased appendix.

Personal observations have enabled me to recognize considerable variations in the length of the appendix, the longest being nearly six inches. Wister[17] alludes to one which was nine inches long. It is frequently seen with an attached fold of peritoneum and fat tissue, suggesting an omentum or mesentery. Its free end has been found in the iliac fossa, as well as behind the caecum; along the brim

[14] Nordiskt Med. Ark., vii. 1. London Med. Record, 1880, viii. 213.
[15] Gerhardt's Handb. d. Kinderkrankh., 1880, iv. 2, 897.
[16] Loc. cit.
[17] Trans. Coll. Phys. Philada., 1856–62, N. S., iii. 147.

of the pelvis and hanging into the cavity of the latter. Irregular positions have often been associated with fibrous adhesions. The appendix has been found thus attached not only in the places above mentioned, but also with its tip directed upward and its course more or less parallel with that of the caecum, either behind, to the right, or to the left of this structure. It has also been found adherent to the mesentery with its tip bent at right angles and lying between the appendix and this structure. Kraussold[18] observed its course directed upward and backward, forming a loop around the ileum with its tip directed forward. It has been seen pointing outward, then forward, forming a loop around the lower end of the caecum with its tip behind the latter.

Firket[19] records the adherence of the appendix to the ileum throughout the length of the former, with a communication between the cavities of the two and without an evident ulceration of the mucous membrane. Adherence to the rectum with a communication between the cavities of each is recorded.[20] Adhesions of the tip to the mesentery, the rectum, and bladder are frequent. Its presence in a hernial canal led Shaw[21] to suspect a disease of the testicle. Thurmann[22] records a like occurrence, and the formation of a scrotal tumor as large as the two fists in consequence of an inflammation of the appendix. Its tip has been found[23] adherent to the abdominal wall in the vicinity of the navel, and pus has been discharged from it at this point.

Complete or partial obliterations of the canal are frequent. In the former instance a solid cord results. In the latter, a considerable cystic dilatation of the tip may follow; or a funnel-shaped pouch at the origin is often associated with obliteration of the remaining portion of the tube.

These variations in length, position, and patency, whether congenital or acquired, are of obvious importance in explaining many of the apparent differences in the clinical histories of typhlitis and perityphlitis. Their significance in the etiology of appendicitis will appear directly.

The frequent presence of foreign bodies in the canal of the appendix is of well-known occurrence. These are a variety of seeds, especially of fruit. Less common are hairs, particularly bristles, worms or their eggs, shot, pins, pills and gall-stones. By far the most numerous are moulded masses of inspissated feces, more or less cylindrical in shape and of extreme variation in density. Some are of the consistency of normal excrement, while others are of stony hardness in consequence of their infiltration with earthy salts. The relative frequency of their presence in the appendix is manifested by the records of fatal cases of appendicitis, but their actual frequency far exceeds the number of these cases. In my own experience it is rather the rule than the exception for the appendix to contain moulded, more or less inspissated feces.

The frequency of such retention may be due to the congenital or acquired peculiarities of the appendix already described. German writers attach a certain

[18] Volkmann's Samml. klin. Vortr., 1881, cxci. 1707
[19] Ann. d. l. Soc. Méd.-Chir. d. Liège, 1882, xxi. 58.
[20] Trans. Lond. Path. Soc., 1876, xxvii. 161.
[21] Ibid., 1848, i. 270.
[22] Prov. Med. and Surg. Journ., 1848, 477.
[23] Lancet, 1839–40, ii. 565.

importance to the presence of a valve-like projection of mucous membrane, discovered by Gerlach,[24] at the mouth of the appendix. Although a pinhole opening may result, any considerable obstruction must be of extreme rarity. The habits of individuals with reference to diet and regulation of the bowels are of unquestioned importance. Equally significant is the controlling fact, that most persons suffering from habitual constipation and accustomed to swallow the seeds of fruit, escape inflammation of the appendix.

Recognizing the lack of agreement in the use of the terms typhlitis and perityphlitis, a collection has been made of 257 cases of perforating inflammation of the appendix. By limiting the attention to the essential features of these cases, it was thought possible to recognize the characteristics of this sharply defined affection, by means of which it might be differentiated from all others occurring in this region. At the same time a comparison is drawn between many of these characteristics and those occurring in cases of typhlitis and perityphlitis. The latter terms are sufficiently indicative of a clinical picture, although its seats and causes suggest the importance of shades of distinction; 209 of these cases have been collected, and serve as the basis of a series of tables to be contrasted with those obtained from the analysis of the 257 cases of appendicitis.

The etiological importance of the presence of fecal masses and of foreign bodies in the production of inflammation of the appendix is well recognized. Matterstock[25] found in 169 cases of fatal perforating appendicitis that fecal concretions were present in 53 per cent, and foreign bodies in 12 per cent. In the series here collected, out of 152 cases the percentage[26] of fecal masses was 47 per cent, that of foreign bodies 12 per cent. It thus appears that in nearly one-half of the cases more or less inspissated feces were found, and that in nearly one-eighth of the series foreign bodies other than feces were present. Thus, in about three-fifths of all cases of perforating inflammation of the appendix either dried feces or foreign bodies were present in the tube. When seeds are stated to have been found, the evidence is not always sufficient to exclude the possibility of a mistake having been made as to the nature of the foreign body. Notwithstanding this large percentage the reality is undoubtedly much greater. Many are overlooked at the time of making the examination, others are macerated in the contents of the abscess. Still others, perhaps, escape with the pus, which makes its way outward through the various channels by which the abscess may communicate with the surface of the body.

The frequent immunity of the appendix from inflammation in the presence of inspissated feces and foreign bodies suggests the importance of other factors in the etiology. External violence is occasionally recorded as an immediate precursor of the attack. Among the 257 cases were 19 who were supposed to have received an injury, the result rather of indirect than of direct violence: from lifting a heavy weight in 9 instances, and from a fall or blow in 10. Among the 209 cases of typhlitis and perityphlitis external violence immediately preceded the attack of the disease in 10 per cent.

[24] Zeitschr. f. rat. med., 1847, vi. 12.
[25] Op. cit.
[26] In general whenever percentages are given, fractions will be disregarded.

Digestive disturbances are of obvious importance in the etiology of inflammation of the appendix, since this organ is a part of the alimentary canal. There were 15 instances of prolonged constipation, 9 of diarrhea and 6 of vomiting. The attacks of diarrhea and vomiting were usually the result of indiscretion in diet, but they were sometimes occasioned by the use of domestic remedies. These were administered for the relief of constipation or other disturbances attributed to a sluggish action of the stomach and bowels.

Among the cases of typhlitis and perityphlitis were 38 of constipation, 15 of diarrhea, and 3 of vomiting; these symptoms being of apparent etiological importance.

Notwithstanding the frequency of typhoid fever and of intestinal tuberculosis, in which affections the mucous membrane of the appendix is often diseased, a resulting perforation seems to have been relatively infrequent. There were 8 of perforating ulcer of the tuberculous appendix, and 3 of this lesion in convalescence from typhoid fever.

Among the 209 cases of typhlitis and perityphlitis were 2 occurring in tuberculous persons.

The conclusion of sex in 247 cases gives the following result: 197 males, 80 per cent., and 50 females, 20 per cent. These percentages are the same as those found by Fenwick[27] in the analysis of 130 cases.

In 209 cases of typhlitis and perityphlitis there were 156 males and 53 females; 74 per cent. of the former, and 26 per cent. of the latter.

The age in 228 cases of appendicitis is recorded as follows:

From 20 months to 10 years	20	= 10 per cent
From 10 years to 20 years	86	= 38 per cent
From 20 years to 30 years	65	= 28 per cent
From 30 years to 40 years	34	= 15 per cent
From 40 years to 50 years	8	= 3 per cent
From 50 years to 60 years	11	= 5 per cent
From 60 years to 70 years	1	= ½ per cent
From 70 years to 78 years	1	= ½ per cent

The age of the youngest patient was 20 months, that of the oldest 78 years; 173 cases, 76 per cent. of the entire list, were under the age of 30 years, and nearly 50 per cent. were under the age of 20 years. Fenwick's[28] table of ages is based upon the consideration of 97 cases, and shows smaller percentages for the several decades up to the age of 40 years.

The age of the patient in 178 cases of typhlitis and perityphlitis was:

From 4 years to 10 years	10	= 6 per cent
From 10 years to 20 years	53	= 30 per cent
From 20 years to 30 years	53	= 30 per cent
From 30 years to 40 years	25	= 14 per cent
From 40 years to 50 years	18	= 10 per cent
From 50 years to 60 years	10	= 6 per cent
From 60 years to 70 years	7	= 4 per cent
From 70 years to 78 years	2	= 1 per cent

[27] Lancet, 1884, ii. 987, 1039.
[28] Loc. cit.

From the above consideration it is apparent that perforating appendicitis is a disease most frequently occurring among healthy youths and young adults, especially males. Further, that attacks of indigestion and acts of violence, particularly from lifting, jumping, and falling, are exciting causes in one-fifth of the cases. A local cause is to be found in more than three-fifths of all cases in the retention in the appendix of more or less inspissated feces, or in the presence there of a foreign body. The retention of feces may be promoted by a constipated habit, but congenital or acquired irregularities in the position and attachments of the appendix frequently act as favoring causes. A fact in support of the last-mentioned statement is to be found in the frequency of successive attacks, one or more, of inflammation of the appendix. Among 257 cases were 28, 11 per cent., which presented similar symptoms of greater or less severity, at various intervals before the final attack. Recurrence is mentioned in 23 out of 209 cases, again 11 per cent, of typhlitis and perityphlitis.

The inflammatory process once excited, its course and results show extreme variations. A simple catarrhal appendicitis is to be recognized anatomically, but it is doubtful whether its clinical appreciation is possible. This appendicitis, in the absence of a concretion or foreign body, may progress toward ulceration, even to a peritonitis, which may terminate fatally. In the presence of a foreign body or concretion these events are of likely occurrence. On the one hand, the inflammation may result in the more or less complete obliteration of the canal of the appendix, with or without circumscribed dilatation. On the other, the ulcerative process becomes associated with a necrosis of the wall, a peritonitis, usually circumscribed at the outset, and perforation. In those cases where the appendicular peritonitis represents the extension of an inflammation through the wall of the appendix without perforation, permanent adhesions of the appendix to neighboring parts remain as evidence of the process. When it is associated with necrosis of the wall, the inflammation of the peritoneal coat tends to become diffused and productive of serous cellular exudations. The adherence of coils of intestine to each other and to the abdominal wall favors the accumulation of the exudation in a limited space, and thus the formation of the tumor. At this stage the anatomical condition is a circumscribed peritonitis, the appendicular peritonitis of With. In certain instances the term perityphlitis might be applied in an exact anatomical sense, as the peritoneal inflammation frequently extends to the serous investment of the lower part of the caecum. But in the last two cases of fatal appendicitis examined by me, the appendicular peritonitis was wholly pelvic. The changes observed in the appearance of the serous covering of the caecum were of the same character as those affecting the peritoneum elsewhere. This peritoneal abscess may then become absorbed, or its contents may escape into the general peritoneal cavity through ruptured or softened adhesions. In the latter event, as a rule, death rapidly follows. The exceptional case reported by Markoe[29] may be regarded as one of extreme rarity. A child with symptoms of general peritonitis on the second day, died a month later from another disease. The appendix had been perforated and the intestines were adherent in different places.

[29] Am. Med. Monthly, 1857, viii. 231.

The product of the circumscribed peritonitis varies exceedingly in quality and quantity. Although it is usually thin, discolored, and very offensive, it may be thick, yellow, and odorless. In the post-mortem examination of a case of recent occurrence, where general peritonitis was the cause of death, the abscess contained perhaps an ounce of pus. The peritonitis was the result of a secondary mesenteric thrombophlebitis, while the primary appendicular peritonitis was apparently in a retrograde condition. The acute stage of the disease lasted more than six weeks. Barrett[30] states that he removed from a perityphlitic abscess, on the sixty-second day, more than a gallon of pus, liquid feces, and scybala. The presence of the last element indicates a communication with the large intestine.

If the case does not terminate as thus stated, a tumor may suddenly diminish in size with the discharge of pus from a hollow organ, as the intestine, bladder or vagina. The anterior abdominal wall may become perforated and a sinus be established opening in the groin, lumbar region, or at the umbilicus. Shaw[31] mentions the occurrence of multiple abscesses of the scrotum from a perforated hernial appendix, and Thurmann[32] records a similar instance. Such sinuses often remain open for a long time, even many years. Through the kindness of Dr. A. T. Cabot of Boston, I saw a patient with a fecal fistula which had existed for nineteen months. At the ouset a tender swelling in the right groin had been incised, but the wound never healed. After an operation to promote the healing of the sinus, about an inch of the perforated appendix protruded from the wound. A similar protrusion had taken place six months earlier. The outer surface of the appendix was smooth, of a dusky red color, and the margin of the opening was sharply defined. Pressure upon the abdominal wall over the caecum caused soft, yellow intestinal contents to appear in the wound.

The abscess may contain sloughs of tissue and yet be intraperitoneal. In a recent post-mortem examination I removed from the encysted abscess around the appendix a slough, three inches in length, representing the detached peripheral portion of the tube. Ballou[33] records a case where the sloughed appendix was discharged per anum, the patient recovering. In the case reported by Pooley,[34] apparently the entire appendix escaped as a slough from the wound.

The more protracted the course of the disease the greater is the probability of the destruction of the peritoneum forming the wall of the abscess. With the perforation of the parietal peritoneum may occur extensive necrosis, purulent and fecal infiltration of the abdominal walls. Within three weeks the iliac muscle may be destroyed and the ilium be bared. The course of the psoas and iliacus may be followed into the thigh, and extensive and deep-seated destruction of tissue with fecal infiltration be present in this region. The pus may extend through the obturator foramen, forming a deep-seated abscess of the hip and thigh, and may enter the hip-joint.

Moore[35] has shown that disease of the hip-joint may follow perityphlitis,

[30] Va. Med. Monthly, 1875–76, ii. 120.
[31] Loc. cit.
[32] Loc. cit.
[33] Trans. R. I. Med. Soc., 1877–82, ii. 418.
[34] N. Y. Med. Record, 1875, x. 267.
[35] Lancet, 1864, ii. 514.

and Gibney[36] has called attention to the possibility of mistaking cases of perityphlitis for disease of the hip-joint. The primary appendicular peritonitis may in like manner be continued into the tissues behind the caecum, and thus a secondary paratyphlitis or perityphlitic abscess be occasioned. So various are these possibilities that every case of so-called perityphlitic abscess must be regarded as primarily one of a perforating appendicitis unless proved to be the contrary.

With the frequent eventual destruction of the peritoneal wall of the abscess is the possibility of death from hemorrhage. Conant[37] describes the case of a young man who died at the end of three weeks. There was no general peritonitis, but the abscess communicated with the caecum (the appendix being destroyed) and held a pint of clotted blood. Fatal hemorrhage from ulceration of the deep circumflex iliac artery is recorded by Bryant.[38] This case is not unlikely to have been one of appendicitis, although the condition of the appendix is not stated. Again, Powell[39] reports a case where the appendix was adherent to the internal iliac artery, the cavities of the two being in communication. The colon and caecum were distended with gas and dark blood.

The occurrence of disease of remote parts may be alluded to, as abscesses of the liver from pylephlebitis or portal embolism in consequence of a mesenteric thrombophlebitis near the appendix. The affection of the liver and portal vein may be the result of a direct continuance of the phlebitis, or may follow putrid embolism from a thrombus in the immediate vicinity of the appendix. The extension of a secondary paratyphlitis may cause perforation of the diaphragm with a consecutive pleurisy or pericarditis.

In considering the symptoms of appendicitis, it is to be noted that attacks of inflammation frequently occur without giving rise to any characteristic symptoms, and often without a suggestion of any distinct malady.

A comparison of the results of post-mortem examinations with the records of the previous histories of patients justifies this statement, unless it be urged that the disease occurred so early in life as to have been unappreciated or forgotten. Out of 227 cases of perforated appendix, however, 22, about 10 per cent, were under the age of ten years. This number is far too small to account for the occurrence of evidences of disease of the appendix in more than one out of every three autopsies.

The records of the Massachusetts General Hospital state than an individual with an appendix a half inch long, thickened, curved and intimately adherent to the thickened and opaque subjacent peritoneum, never had symptoms of inflammation in this region. Another patient was never sick before his fatal illness, although the appendix and caecum were closely united to the neighboring parts by old fibrous adhesions and the canal of the appendix was obliterated. Still another patient was always well and strong till within eleven days of his death, yet the appendix was converted into a solid fibrous band intimately united by firm adhesions to the posterior wall of the caecum. The severity of these lesions

[36] Am. Journ. Med. Sci., 1881, lxxxi.
[37] Am. Med. Monthly, 1858, x. 359.
[38] British Med. Journ., 1884, ii. 43.
[39] N. O. Med. and Surg. Journ., 1855, xi. 468.

suggests the probability that apparently slight disturbances of digestion were overlooked. The diarrhea, constipation, or abdominal pain, especially when occasionally recurrent, were regarded as characteristic of a feeble digestion. There can be but little doubt that a diagnosis of bilious attack, colic, gastritis, enteritis, gravel, ovaritis, congestion of the womb and the like, may not unquently conceal the existence of an inflamed appendix.

The latency of the symptoms in certain cases of appendicitis is such that the eventual diagnosis is obscured, and the desirable method of treatment hopelessly postponed. Buck[40] reports that a sailor was at work rolling barrels of flour till the day of his admission to the hospital. He then had a prominent iliac tumor extending along the outer half of Poupart's ligament. Fluctuation was transmitted from it to below the inner half of the ligament. Another sailor left Portland for New York, April 12, 1886, and arrived five days later. In the meantime, he purged himself in consequence of a right iliac pain. Although suffering, he kept at work during the following week. He then left for Boston, where he arrived on the thirteenth day after the beginning of the pain. Symptoms of general peritonitis were evident, and he died the next day. General peritonitis was present, the result of an encysted inflammation about the appendix. This organ formed a gangrenous slough lying in the cavity of the abscess.

The latency as well as the frequent obscurity of the symptoms of appendicular inflammation are thus apparent. The presence, therefore, of the symptoms now to be mentioned, in individuals from whom the history of one, and particularly of several such attacks is to be obtained, is of marked importance in aiding diagnosis.

Sudden, severe abdominal pain is the most constant, first, decided symptom of perforating inflammation of the appendix. It occurred in 216 out of 257 cases, 84 per cent. In most instances it is present in apparently healthy individuals, in a few it follows an attack of diarrhea.

The pain is usually intense, rarely slight, and is occasionally accompanied by a chill, or nausea and vomiting.

The following table shows its localization in 213 cases of appendicitis, and, by way of contrast, in 92 cases of typhlitis and perityphlitis:

	Appendicitis			Typhlitis and Perityphlitis		
	Cases		Per cent.	Cases		Per cent.
In right iliac fossa	103	=	48	55	=	60
In abdomen	75	=	36	31	=	34
In hypogastrium	11	=	5	0		
In umbilical region	9	=	4	2	=	2
In epigastrium	4	=	2	4	=	4
In stomach	3	=	1	0		
In hepatic region	3	=	1	0		
In left iliac fossa	3	=	1	0		
In right hip and groin	1	=	½	0		
Total	213			92		

[40] New York Medical Journal, 1866, ii. 40.

It is quite probable that the number of cases of more exactly localized pain would have been considerably greater had attention been specially directed to this point. Many of the recorded cases of abdominal and hypogastric pain would undoubtedly have permitted a more definite localization, especially as firm pressure often discloses a sensitive spot at some distance from the referred seat. Though usually limited to the fossa, the pain sometimes extends upward as far as the liver, or downward to the rectum, testicle, perineum, or thigh. The attack is occasionally associated with great nervous anxiety, and is at times followed by marked prostration, from which the patient rallies in the course of a few hours.

This sudden intense pain is presumably due, not to the actual beginning of the disease, but to the separation of the fresh adhesions of an acute appendicular peritonitis, and often, perhaps usually, to the perforation of the inflamed appendix. It generally represents the beginning of a more extensive peritonitis. An attempt has been made to ascertain the date of occurrence of this most important symptom. This was possible in 61 cases of appendicitis, and in 64 cases of typhlitis and perityphlitis. It occurred as follows:

	Appendicitis		Typhlitis and perityphlitis	
	Cases	Per cent.	Cases	Per cent.
On the 1st day in	41	67	48	75
On the 2d day in	5	8	10	16
On the 3d day in	12	20	2	3
On the 4th day in	2	3	4	6
On the 5th day in	1	2	0	
Total	61		64	

If the pain is not accompanied by nausea and vomiting, these symptoms are not unlikely to follow. Their occurrence is recorded in 15 cases of appendicitis, and in 44 out of 209 cases of typhlitis and perityphlitis. The vomit quickly becomes green in color, but in general this symptom is not distressing at this stage of the disease. Diarrhoea is rarely present, while constipation is the rule.

The abdominal pain is followed by fever as the next constant symptom. The date of its appearance is noted in but 38 cases of appendicitis, and in only 16 of typhlitis and perityphlitis. It was present in:

	Appendicitis	Typhlitis and perityphlitis
On the 1st day in	5 cases	6 cases
On the 2d day in	18 cases	7 cases
On the 3d day in	9 cases	0 cases
On the 4th day in	6 cases	3 cases
Total	38 cases	16 cases

The temperature is rarely very high, and the constitutional disturbances usually associated with an elevated temperature are frequently slight, if not absent. The maximum recorded in the cases here collected is 103.5°F., but the range is usually between 100°F. and 102°F. With[41] noticed an elevation of nearly

[41] Loc. cit.

06°F. If violent or extreme changes take place, a complication may be expected, as an abscess of the liver, or a pleurisy from an extension of the local inflammatory process.

During the first three days following the onset of pain, micturition is occasionally disturbed. Perhaps unusually frequent on the first day, it is likely to be difficult on or after the third day. In certain instances the use of the catheter is required. A satisfactory explanation of this latter feature is to be found in the abundant use of opium, usually necessary at this stage of the disease. The right testicle may be retracted and swollen, in which case the course of the pain is apt to be toward this gland.

The circumscribed swelling in the right iliac fossa now demands consideration. This symptom, when present, is evidently of the utmost value in diagnosis, as its appropriate treatment most favorably modifies the prognosis. The swelling represents the accumulation of the increasing exudation, at the outset the product of the peritonitis, and lies beneath the adherent coils of intestine which later become attached to the abdominal walls. Its usual seat is in the right iliac fossa, below a line extending from the anterior superior spine of the ilium to the navel, nearer the former and two finger-breadths above Poupart's ligament. It may lie nearer the median line or may approximate the iliac crest. The swelling may be found in the pelvis in those cases where the appendix becomes attached to the peritoneum of the pelvic wall. It is rare for the primary swelling to be paracaecal, although this variety occurs where the appendix lies embedded behind the caecum.

The early products of the peritonitis are largely cellular and fibrinous; scanty, opaque, greenish masses are found encapsulated. This condition is obviously not to be recognized by physical signs. As the liquid exudation increases, dulness becomes apparent. This sign may be obscured by intervening and adherent coils of intestine, especially if they are distended with gas, when a superficial gurgling may be recognized. Again the contents of the abscess may be partly gaseous, a condition more likely to occur later in the course of the disease. A circumscribed resistance is felt on palpation. As the part is often extremely sensitive to pressure and the abdominal muscles tense, the administration of ether or chloroform may be necessary to confirm the diagnosis. A rectal examination not infrequently permits the recognition of the tumor which abdominal palpation fails to disclose, and should always be made in the latter event. Owing to the position of the abscess beneath the transversalis fascia, and to the fact that it is often covered by adherent coils of intestine, a sense of fluctuation is rarely perceived till much later in the history of the case.

The clinical characteristics of the tumor and its composition are thus made evident by modified resonance on percussion, circumscribed resistance on palpation, and a sense of fluctuation. Notwithstanding the importance of these signs, the records of 257 cases of appendicitis give comparatively little information with reference to the date of their appearance. The 209 cases of typhlitis and perityphlitis give a more satisfactory result.

Dullness was first noticed on the

	Appendicitis	Typhlitis and perityphlitis
1st day in	0 cases	2 cases
2d day in	2 cases	0 cases
3d day in	1 cases	7 cases
4th day in	4 cases	5 cases
5th day in	1 cases	2 cases
6th day in	2 cases	0 cases
7th day in	1 cases	1 cases
8th day in	1 cases	4 cases
9th day in	0 cases	1 cases
10th day in	0 cases	3 cases
Total	12 cases	25 cases

Palpation showed in the presence of the tumor on the

	Appendicitis	Typhlitis and perityphlitis
1st day in	1 case	4 cases
2d day in	3 cases	6 cases
3d day in	4 cases	8 cases
4th day in	2 cases	8 cases
5th day in	4 cases	3 cases
6th day in	5 cases	6 cases
7th day in	4 cases	4 cases
8th day in	1 case	7 cases
9th day in	0 case	11 cases
10th day in	0 case	11 cases
Total	24 cases	68 cases

An attempt has been made to determine the date at which fluctuation becomes evident. As a rule, its appearance is so late in the course of the disease (after the second week) as to be of little diagnostic value. An exploratory puncture with the needle of the aspirator is frequently recommended to determine the nature of the tumor. Too much stress is not to be laid upon this method of examination. If the aspirator fails to show the presence of pus, even after repeated punctures in divers spots, it by no means follows that pus is absent. Operators have frequently exposed the transversalis fascia over the tumor and have then punctured it in several places. Pus not appearing, the wound has been dressed. In the course of a few hours an abundant discharge of fetid matter has made its appearance in the dressings and at the bottom of the wound.

It is evident from the consideration of the above table, that the presence of the abscess may be expected as early as the third day. It may be large enough to contain some three pints of fluid on the fifth day. The following case reported by Peckham[42] apparently justifies the above conclusions. His patient was a man of twenty-seven years of age, who had suffered from abdominal pain and diarrhoea for twenty-four hours. He was then seized with a severe pain in the right

[42] Boston Med. and Surg. Journ., 1882, cvi. 159.

iliac fossa, which was fuller than the left, tender, and dull. On the following day the whole abdomen was tender, but there was no complaint of pain. The day after, there were great tenderness, dyspnoea, cold hands and feet. The next day, the fifth of the disease and the fourth from the occurrence of the right iliac pain, the patient died. There was acute peritonitis. In the lower part of the abdomen was a space bounded by the bladder, iliac bones, and small intestine, the latter pushed up and covered by false membrane. In the cavity were nearly three pints of fetid, purulent fluid.

The chief danger from the appendicular peritonitis is that it becomes general. Many of the records mention the time of occurrence, not only of the iliac pain, but also of the subsequent general abdominal pain. The latter is to be regarded as suggestive evidence of the beginning of a general peritonitis, as the former calls immediate attention to the exact nature of the disease. The date of its occurrence is recorded in about one-fourth of the cases of appendicitis, most of which were fatal, while it is noted in but one-tenth of the cases of typhlitis and perityphlitis, which were nearly all instances of recovery.

General abdominal pain was present on the:

	Appendicitis	Typhlitis and perityphlitis
1st day	1 case	0 cases
2d day	11 cases	6 cases
3d day	21 cases	8 cases
4th day	12 cases	4 cases
5th day	8 cases	0 cases
6th day	5 cases	1 case
7th day	5 cases	0 cases
8th day	4 cases	0 cases
9th day	2 cases	0 cases
11th day	3 cases	0 cases
Total	73 cases	19 cases

In one of the cases in which this symptom appeared on the first day death occurred on the fourth day. It was stated that there was no perforation of the appendix, although this structure presented a deep purple color and contained a fecal concretion. General peritonitis was present and a considerable quantity of pus was found in the pelvis and vicinity of the appendix. In the other case the general abdominal pain came on three hours after moderate pain in the bowels. It radiated from the right iliac region. In sixty-six hours the patient was dead. The intestines were glued together by a butter-like lymph, but there was no serous or sero-purulent exudation.

It was thought desirable to ascertain the date at which tympanitic distention of the abdomen appeared. At the same time it is recognized that this sign of a general peritonitis is of considerably less value than that already stated.

Tympanites was present on the

	Appendicitis	Typhlitis and perityphlitis
1st day	0 cases	1 case
2d day	7 cases	5 cases

3d day	13 cases	8 cases
4th day	14 cases	2 cases
5th day	3 cases	2 cases
6th day	1 case	1 case
Total	38 cases	19 cases

The second, third, and fourth days are those which include the largest number of cases of beginning general peritonitis. In sixty per cent of the cases of appendicitis, as inferred from the nature of the pain, and in nearly ninety per cent as suggested by tympanites. The source of this early peritonitis is to be found in most instances in the escape into the peritoneal cavity of the inflammatory product encysted near the appendix. Although usually small in quantity at this early period, its quality is exceedingly acrid.

The speedy death of the patient almost invariably results from the occurrence of the general peritonitis. In 176 cases the day of death was as follows:

On the 2d day in 8 cases 4 per cent. On the 3d day in 20 cases 11 per cent. On the 4th day in 12 cases 7 per cent. On the 5th day in 20 cases 11 per cent. On the 6th day in 16 cases 9 per cent. On the 7th day in 22 cases 12 per cent.	98 in the 1st week. 56 per cent.
On the 8th day in 21 cases 12 per cent. On the 9th day in 10 cases 6 per cent. On the 10th day in 8 cases 4 per cent. On the 11th day in 6 cases 3 per cent. On the 12th day in 4 cases 2 per cent. On the 13th day in 4 cases 2 per cent. On the 14th day in 1 case.	54 in the 2d week, 31 per cent.
On the 15th day in 3 cases. On the 17th day in 1 case. On the 18th day in 1 case. On the 19th day in 1 case. On the 20th day in 2 cases.	8 in the 3d week, 4 per cent.
In the 4th week in 7 cases 4 per cent In the 5th week in 4 cases 2 per cent In the 7th week in 4 cases 2 per cent In the 8th week in 1 case ½ per cent	

In fatal cases sixty-eight per cent, more than two-thirds, die during the first eight days, and two-thirds of these die between the fourth and eighth days inclusive.

Errors in the diagnosis of appendicitis have been numerous, chiefly because the cardinal symptoms of localized pain, general heat, and circumscribed swelling have not been duly appreciated in their defined sequence. Again, the extreme rarity of acute perforating inflammation of the caecum, as compared with that of the appendix, has not been made sufficiently conspicuous. The acute form of perforating appendicitis has been confounded with inflammation of the caecum

or typhlitis in an exact sense, intestinal obstruction from intussusception or strangulation, pelvic peritonitis (haematocele) of vesical, ovarian, tubal, or uterine origin, psoitis, and renal or biliary colic. More rarely a movable kidney or a foreign body in the bladder has been suspected.

The chronic appendicular peritonitis and the chronic paratyphlitis resulting from a perforated appendix, have been confounded with the results of caries of the spine and hip-joint, suppurative nephritis, intestinal tuberculosis, and cancer of the caecum. An appreciation of the previous history of the patient, the seat and character of the pain, the period of occurrence of the fever and the date of the appearance of the tumor are necessary for an eliminative diagnosis.

A primary perforating inflammation of the caecum is extremely rare even in chronic dysentery or in chronic tuberculosis. In an extensive research into the literature of the subject but three cases of acute primary perforation of the caecum have been found. One from a fishbone, another from a pin, and the third from strangulation of the bowel. Two cases of rupture of the caecum are recorded. So rare is the affection in question that the possibility of a primitive, perforating caecitis may be disregarded. Bartholow's[43] communication on this subject relates rather to the secondary perforation of the caecum from without.

Stercoral caecitis, on the contrary, is exceedingly common, and is, perhaps, the most important of all the conditions with which the perforating appendicitis may be confounded. The history of this affection usually makes evident a period of protracted constipation in a person not especially young, vigorous, and apparently healthy, who may have had similar attacks. The pain is trifling for a long time, and the sensitiveness slight. Fever is absent, or of late occurrence. The tumor is present at the beginning as a distinct nodular or doughy mass, elongated and in the lumbar region. It is unnecessary to say that from a stercoral caecitis may arise a perforative appendicitis which may end in perforation.

Many of the so-called cases of typhlitis terminating in resolution, associated with fecal retention, and persisting after the removal of the feces, are undoubtedly of this nature.

Intestinal obstruction from intussusception or strangulation is characterized by the frequent absence of a suggestive previous history. The pain is not so localized or intense, and the fever is not conspicuous at an early stage.

The abdomen is distended and tympanitic at the outset, and is, at the same time, unusually sensitive. Borborygmus and perceptible movements of the intestine are associated with or followed by fecal vomiting. Obstinate constipation and the retention of flatus are noticeable. The tumor is absent when the intestine is strangulated, and it is elongated, sausage-like, usually following the course of the colon when intussusception is present. Tenesmus and the rectal discharge of bloody mucous are important signs of the latter affection, though they may occur when the appendix is inflamed.

As four-fifths of the cases of appendicitis occur in males, and as pelvic peritonitis suggests a doubt as to its diagnosis almost invariably in females, it is evident that the question of sex is of eliminative value in certain cases. But the

[43] American Journal of the Medical Sciences, 1866, N. S., lii. 351.

doubt may arise in the case of the female. Barker[44] has reported two cases, the one of haematocele, fatal in forty-eight hours, diagnosticated as inflammation of the appendix. The second patient also died on the second day; the autopsy showed an inflamed appendix and pregnancy, although the patient was supposed to have had a haematocele. Suppressed catamenia and the incipient symptoms of appendicitis not infrequently coexist. Again, the occurrence of symptoms of appendicitis within twenty-four hours after delivery is occasional, and more rarely it represents a cause of abortion. In general, the symptoms and progress of a pelvic peritonitis of pelvic origin would not be likely to suggest an inflamed appendix. The symptom which is of the greatest value in determining the onset of an appendicitis after delivery, is to be found in the rapid development of the tumor without an obvious cause. When the appendicular peritonitis is pelvic in its localization, the previous history and the absence of evidence of disease of the genital tract are to be relied upon to direct attention to the appendix as the cause.

An inflammation of the psoas muscle may be the result of an appendicitis. If due to other causes, and acute in character, the digestive disturbance is lacking, and the pain and sensitiveness are less, the tumor is more vaguely defined and tympanitic from its deep seat, while the motion of the leg is early impaired. A primary, acute, suppurative process is of doubtful occurrence.

A biliary colic is rarely likely to suggest an inflamed appendix. The seat and nature of the pain, the absence of fever and peritonitis during the first week, and the possible occurrence of jaundice, would tend to eliminate this affection.

In the passage of a renal calculus the seat and character of the pain differ. Fever and the iliac pain are absent. There is no iliac tumor, and the examination of the urine may indicate the probable presence of a foreign body in the ureter.

In chronic cases of inflamed appendix the abscess is evident, and its treatment apparent. It may be mistaken for a psoas abscess of spinal origin. If the latter affection is present, evidence of disease of the vertebrae is usually to be obtained. In disease of the hip-joint the impaired mobility and localized sensitiveness of this articulation will be found more extreme than is apparent in the flexed and adducted thigh, usually connected with a chronic perityphlitic abscess.

The history of the cases of intestinal tuberculosis, chronic suppurative nephritis, and cancer of the caecum are sufficient to eliminate these causes of iliac and lumbar tumors, when disease of the appendix is under consideration.

Perforating inflammation of the appendix sometimes proves fatal from shock. Death usually follows from the production of a general peritonitis by the direct extension of an appendicular peritonitis, or by the rupture of adhesions producing an intervening, encysted, peritoneal abscess. A general peritonitis may also occur by the intervention of a mesenteric thrombophlebitis and its continuance to the portal vein and liver, with or without portal embolism. Among the 257 cases of perforating appendicitis are 11 of pylephlebitis.

In the protracted cases death may result from exhaustion. Shock proves fatal

[44] New York Medical Record, 1880, xviii. 663.

within the first two days, death from an extended peritonitis within the first week, and from a secondary general peritonitis, as a rule, during the first two weeks.

The termination in resolution of a perforating appendicitis undoubtedly occurs, but our present sources of information give no absolute evidence as to the relative proportion of this class of cases to those ending fatally. The consideration of a large number of cases of typhlitis and perityphlitis, offers a suggestion as to the possible frequency. Of 180 cases thus designated there terminated

By resolution	58	32 per cent
Spontaneous evacuation	33	18 per cent
Operation	89	50 per cent
		180 per cent

It will be generally admitted that the spontaneous evacuation of a perityphlitic abscess is an event to be anticipated and guarded against. Apart from the consequent dangers which may result, possible fatal complications which may precede the time of its expected occurrence are a sufficient warning. It is, therefore, important to bear in mind that two-thirds of the cases of typhlitis and perityphlitis above tabulated, were of unquestioned abscess.

The termination by resolution of nearly one-third may seem a sufficient warranty for recognizing this result as frequent enough to be anticipated in all cases.

That this conclusion is not justified appears from the fact that twelve of these, about one-fifth of the entire number, thus terminated at the end of the second week. Operative interference is demanded before this time in two-thirds of all cases, hence but one-fourth may be expected to undergo resolution.

An additional argument against the plan of waiting with the hope of the occurrence of resolution, is to be found in the frequency of recurrent attacks. Recurrence is recorded to have taken place in 28 out of 257 cases of appendicitis, and in 23 out of 209 cases of typhlitis and perityphlitis; that is, in about eleven per cent of each. It is at least suggestive of the importance of not waiting too long for resolution, that the number thus terminating during the last two days of the second week is seven per cent of those ending in resolution. This number may include a considerable part of the recurrent cases which operative interference would have prevented.

The possibility of a termination by resolution must be recognized, and the earliest therapeutic efforts should have this result in view; especially as these efforts also tend toward localizing the peritonitis. But, as Pepper[45] states, "the unjustifiable delay permitted in many cases of typhlitis, whilst hoping day after day for the more definite detection of suppuration, is the direct cause of many avoidable deaths."

To keep the bowels quiet should be the first and last thought. Absolute rest in bed, liquid diet in small quantities often repeated, and, above all, sufficient

[45] Ext. Trans. Med. Soc. of Penna., 1883.

opium to neutralize pain. A sufficiency may seem enormous. Petrequin[46] gave a grain of opium every hour till the pain was relieved, with the result of administering 107 grains in six days. Clark[47] gave a boy, fourteen years old, 1350 drops of laudanum in one day.

A cathartic or a laxative may be demanded by the patient or friends, and an enema be thought desirable as a diagnostic aid. It is to be remembered that these may be the means of at once exciting a general peritonitis. With[48] states that in the milder cases the pain disappears in a few days, vomiting ceases, and within five or six days tenderness and distention disappear. The bowels open spontaneously a few days after the discontinuance of the opium. They may remain bound for twenty-four days, yet the general health need not suffer. Recovery may proceed quietly, steadily, and without disturbance, and the appetite return long before the bowels are opened.

If, after the first twenty-four hours from the onset of the severe pain, the peritonitis is evidently spreading, and the condition of the patient is grave, the question should be entertained of an immediate operation for exposing the appendix and determining its condition with reference to its removal. If any good results are to arise from such treatment it must be applied early. Burchard[49] is an enthusiastic advocate of "lumbar typhlotomy in acute perforating typhlitis." No surgeon would hesitate to give this additional chance for life, were he satisfied that perforation had actually occurred and a general peritonitis was imminent.

If surgical interference is not instituted within the first twenty-four hours after the onset of the sudden and intense right iliac pain, to keep the bowels quiet must still be the injunction. The formation of the tumor, the circumscribing of the peritonitis, is then to be awaited. It is sure to form, in the large majority of cases, if the patient lives long enough. It is only in a small fraction that it occurs before the third day. In more than two-thirds of the cases the contents will escape externally or internally. Without surgical aid the escape is into the peritoneal cavity in most instances, with a rapidly fatal result. In a smaller number the escape elsewhere not infrequently produces serious if not fatal sequels.

Iliac abscesses were sometimes incised before the days of Dupuytren and Grisolle.[50] The latter writer recommended that they should be opened as soon as fluctuation could be detected, in opposition to the generally prevailing view that nature should take its course. It was left to Mr. Hancock,[51] however, to operate before this sign could be recognized. He advocated incision into the tumor in certain stages and forms of mischief, resulting from the presence of impacted feces or foreign substances in either the caecum or its appendix, which have hitherto, for the most part, invariably proved fatal. He contended that the

[46] Gaz. Med. de Paris, 1837, 2me S., p. 438.
[47] Amer. Med. Times, 1861, iii. 258.
[48] Loc. cit.
[49] N. Y. Med. Journ., 1881, xxxiii. 1.
[50] Arch. Gén. de Méd., 1839, iv. 314.
[51] London Med. Gaz., 1848, N. S., vii. 547.

typhoid condition into which patients affected with peritoneal inflammation fell, did not depend upon the violence of the disease, but upon the effused fluid, the removal of which he thought the only chance of saving the patient. His reasons for operating in the given case are thus stated: "As she was evidently sinking, and the previous treatment had been of no avail, I proposed to make an incision from the spine of the ilium to the inner side of the internal abdominal ring over the hardened spot, so that if it were intestine or omentum it could be freed, or if, as was thought more probable, matter had collected in the right iliac fossa, it could be let out, and thus give our patient a chance for recovery."

Some years later Lewis[52] contributed a paper on abscess of the appendix, which included an abstract of forty-seven cases, only one of which recovered. He referred to Hancock's communication, and urged the propriety of opening the tumor in case of threatening urgency even if fluctuation were absent. Willard Parker,[53] however, deserves the credit of having demonstrated the success of this operation in three out of four cases, and it is his advocacy of an early operation which has produced such favorable results since 1867. He thought surgery useless in the absence of adhesions, but opportune after the fifth day, when their presence is probable and the fear of rupture imminent. He considered that an incision made between the fifth and twelfth days was practicable, safe, and justifiable. Even when the diagnosis was doubtful, "if no abscess had already formed, in case one should be in process of formation, an external opening would tend to make it point in a safe direction, and if no abscess should form, a free incision would relieve tension, thus adding to the comfort of the patient and in no way prejudicing his safety."

In 1873 W. T. Bull[54] published an admirable paper on perityphlitis, based upon an analysis of sixty-seven cases thus designated. Thirty-two, nearly forty-eight per cent, terminated fatally, and in fifteen of these there was perforation of the appendix. Noyes,[55] in 1882, collected a series of one hundred cases of perityphlitis treated by operation, of which eighty were published after the appearance of Parker's paper. Of these fifteen died, fifteen per cent of the whole. Even this greatly lowered mortality might have been diminished by excluding one case of cancer and another of phthisis. The almost invariable fatality, in Mr. Hancock's time, of cases not terminating in resolution has thus been reduced to less than fifteen per cent by the general acceptance of a given operation under definite conditions.

In the table[56] which has been prepared to show the day of death in cases of perforating appendicitis, it appears that 60 out of 176 cases, 34 per cent, died during the first five days. This early mortality is sufficiently explained by the consideration of the table[57] of symptoms indicating the onset of a general peritonitis. It appears that of 73 cases of general abdominal pain, this symptom appeared during the first five days in 54 instances, 74 per cent. Tympanites

[52] N. Y. Journ. of Med., 1856, i. 328.
[53] N. Y. Med. Record, 1867, ii. 25.
[54] N. Y. Med. Journ., 1873, xviii. 240.
[55] Reprint from Trans. R. I. Med. Soc. for 1882–83.
[56] Page 337.
[57] Page 336.

was noticed during the same period in 37 out of 38 cases, or 97 per cent. It is thus evident that the earliest date fixed by Dr. Parker is too late to afford the possibility of relief in more than one-fourth of all the cases. But early as this date may seem, it has almost universally been the custom to postpone the time of operating till later in the course of the disease. The following table is based upon the analysis of 87 cases of typhlitis and perityphlitis. The operation was performed

On the 3d day in 1 case On the 5th day in 1 case On the 6th day in 3 cases On the 7th day in 3 cases	8 =	9 per cent.
On the 8th day in 7 cases On the 9th day in 3 cases On the 10th day in 11 cases On the 11th day in 4 cases On the 12th day in 4 cases On the 13th day in 6 cases On the 14th day in 6 cases	41 =	41 per cent.
On the 15th day in 5 cases On the 17th day in 4 cases On the 18th day in 2 cases On the 19th day in 1 case On the 20th day in 3 cases	15 =	17 per cent.
After 3d week	23 =	26 per cent
	87	

Hence, if the indications for operating justified the election of a date as early as the fifth day, they still more justify the choice of the third day.

The result has shown the wisdom of the former step, and the evidence here presented seems not only to warrant, but to demand the latter. It is evident that the operation to be performed is that of opening the abdominal cavity. It is, therefore, unnecessary to state that an act which twenty years ago might have added to the risks of the patient, may at the present time, when properly performed, be confidently expected to reduce them very materially.

That the incision of the tumor, in cases of perityphlitis, is even now frequently omitted, is apparent from the consideration of the cases of inflamed appendix recently recorded. Of 57 cases occurring, for the most part, during the past five years, there were signs of a tumor in 16; an operation was performed in only 7. The tumor was opened in 4 cases, twice successfully. Laparotomy was performed as a last resort in 3 instances, the diagnosis being intestinal obstruction; the cause of the peritonitis was not discovered, and death speedily followed.

Notwithstanding this evidence of a fatal delay in the appropriate treatment of cases of appendicitis, the tendency to the performance of an earlier operation is growing. Bull[58] states that he operated on the third day after the patient was seized with chill, fever, vomiting, and constipation. There were severe right iliac pain and increased resistance on pressure. The aspirator showed pus in the

[58] New York Medical Record, 1886, xxix. 267.

lumbar region, and an abscess was opened behind the colon. Death occurred two days later and the autopsy showed a perforated appendix, paratyphlitis, and general peritonitis.

Barlow and Godlee[59] made an exploratory incision in the median line on the fifth day. They found early general peritonitis and lymph near the caecum surrounding a collection of fetid pus, presumably of appendicular origin. A second incision was made over the latter. Recovery took place.

Homans[60] operated successfully on the sixth day of the disease, probably perforation of the appendix, and the second day after the patient was seen by his physician, Dr. Greene, of Dorchester. The incision was made into the abdominal cavity over the seat of pain. The adherent intestines were separated, and some two ounces of pus removed.

Keen[61] also operated on the sixth day after the occurrence of sudden, intense, right iliac pain. Although the symptoms had been characteristic, they were abating. There was increased resistance, however, dullness on deep pressure, a doughy sensation, and considerable oedema in the right iliac fossa. The aspirator showed pus, and a pint was removed after the abscess was opened.

The presence of a general peritonitis does not contraindicate the operation. The case of Barlow and Godlee shows that the general peritonitis may have begun yet the patient recovered. Treves[62] operated upon a case of peritonitis of two days' duration, supervening upon an attack of pelvic peritonitis of some three months' standing. The patient recovered. Mikulicz[63] operated on the sixth day after the sudden right iliac pain in a case where there was evidence of rupture of the abscess into the general peritoneal cavity on the fourth day. The wound was closed, slight improvement followed, but death occurred on the eleventh day.

If the encysted peritonitis becomes general, death has heretofore been almost inevitable. It is thus obvious that if laparotomy was successful in two out of three cases where a secondary general peritonitis was present, there is more than a chance of recovery by its use even in hitherto necessarily fatal cases. But it should be employed only when suitable, and not as a last resort when patients are moribund.

In conclusion, the following statements seem warranted:

The vital importance of the early recognition of perforating appendicitis is unmistakable.

Its diagnosis, in most cases, is comparatively easy.

Its eventual treatment by laparotomy is generally indispensable.

Urgent symptoms demand immediate exposure of the perforated appendix, after recovery from the shock, and its treatment according to surgical principles.

If delay seems warranted, the resulting abscess, as a rule intraperitoneal, should be incised as soon as it becomes evident. This is usually on the third day after the appearance of the first characteristic symptom of the disease.

[59] Medical Times and Gazette, 1885, ii. 852.
[60] Boston Medical and Surgical Journal, 1886, cxiv. 388.
[61] Medical and Surgical Reporter, 1886, liv. 165.
[62] Medico-Chirurgical Transactions, 1885, 2d series, l. 175.
[63] Volkmann's Samml. klin. Vortr., 1885, cclxii. 2313.

BOOKS RECEIVED

Books received are acknowledged in this section, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Resection-Reconstruction of the Hip. Arthroplasty with an Acrylic Prosthesis. Edited by K. I. NISSEN. Jean Judet, Robert Judet, Jean Lagrange, Jean Dunoyer, E. & S. Livingstone Ltd., Edinburgh and London, 1954. $7.00.

Financing Hospital Care in the United States, Volume 1. Factors Affecting the Costs of Hospital Care. Edited by JOHN H. HAYES. New York, The Blakiston Company, Inc. $4.00.